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The Status of Geography and the Rôle of Field Work

Address to the Geographical Association

PROFESSOR S. W. WOOLDRIDGE, C.B.E.

President 1954

MY TITLE ASSOCIATES two topics which have rarely, I think, been considered together, though I am sure that it is highly important that they should be so associated.

For a starting point I go back to what was in effect the inaugural meeting of the Association. In his reminiscenses our first secretary Mr. B. B. Dickinson recalls how 62 years ago in January 1893 he distributed a circular calling a meeting of school masters and others interested in geography, at Oxford. Mackinder took the chair at the meeting and after summing up the discussion proposed the formation of an Association for the improvement of the status and teaching of geography. As I look round this morning it is instructive to recall that only two headmasters and representatives of eight schools attended; six years were to elapse before the membership, now 3,700, reached the figure of 100. Even in our moods of frustration and disillusionment we can note, not indeed with complacency but with solid satisfaction, the progress since achieved.

As I look back to that founding motion of Mackinder's several reflections arise in my mind which I venture to pass on to you. Firstly I note that both school and university geographers were present and active at the inauguration, the latter in the person of its chief pioneer and exponent. I have watched with grief and consternation the widening gap in this Association between the school and university teachers of the subject. British geography is rather too prone to a certain fissiparous tendency. Firstly there is the cleavage, or difference in point of view, often manifest at the Royal Geographical Society between the "explorer-cartographer" fraternity and the so-called "academic" geographers. This is of old standing and need not concern us here except to note that in this as in other cases "academic" is an adjective applied to those who understand their work by those who do not. But let me say very flatly that this Association will ill-advance

➤ Professor Wooldridge, of King's College, University of London, delivered his presidential address on 4th January, 1955, during the Annual Conference of the Association.

the twin aims announced at its foundation if the two main bodies of teachers of the subject do not remain in close contact and frequent conference.

The Joint School of Geography at King's College and the London School of Economics is in some sense the host Department for this January Conference, and I have myself attended it regularly since my first appointment as a junior lecturer in January, 1922. Yet during this period of thirty-three years I am only the third University professor, in office, to have been honoured by election to your presidential chair. Of far more import is the, for me, grievous fact that this year, for the first time, the dates of the conference are such as to make it almost impossible for University geographers to attend. The Institute of British Geographers is concurrently in session at Durham, a meeting which my colleagues and I are naturally keen to attend, for the Institute is essentially the representative and meeting place of the University geographers of Britain. If we want effectively to impinge upon or "present a front to" the world at large or the educational authorities we should do well to adopt as marching orders the familiar words of the hymn "we are not divided all one body we" and to make it so at least to the rudimentary extent of planning and controlling the dates of our meetings. I am not unaware of the difficulties but I do not believe they are insuperable.

For many years following its foundation, 20 years ago, the I.B.G. functioned in some sense as the University section of the Association. But with its vigorous present life and a membership of 400, it has been natural, inevitable, and no doubt desirable, that the younger body should move towards full independence. But it is not beyond the wit of man to secure a sufficient measure of spatial and temporal juxtaposition between the two conferences to render cross-fertilization possible.

But you may be moved to ask and you will in fact be wise to ask what forces or tendencies foster the separation I have noted. My own diagnosis is as follows. On the one hand the university teachers are inclined to feel that our programmes are too preoccupied with "education" and too little with geography or to be more explicit what may be called "research geography." On the other hand when we do publish papers which are additions to knowledge I am told of outbursts from teachers who say that they are not interested in research. I must beware here of the invidious pitfalls of picking examples, but I will risk one. Turn back to *Geography* for April, 1953. This is the sort of part which warms my own heart since it registers advances of geography as a subject. It includes *inter alia* Mr. Waters' paper on "Aits and breaks of slope on Dartmoor streams." But when I ventured to express to our Honorary Secretary my appreciation of this part and this paper I was told that I should have seen the adverse comments in letters from primary school teachers and others. We will let them remain

anonymous but I put it now to you personally. Is your attitude the narrow and, I do not hesitate to add, contemptible one that you have no use for it because there will be no questions in the G.C.E. examination on aits or Dartmoor streams? If so I charge you with being in the worst sense "non-academic" geographers, conspicuous for ignorance and lack of imagination. I cannot develop the theme fully here but consider only for a moment what river islands have meant in terms of river-crossings and town sites. Do we then accept them as inexplicable "Acts of God" and despise careful investigation designed to illumine their origin? Is this as some might hasten to say "mere physiography"? If these are our attitudes we shall ill-advance the status of our subject and I doubt also if we shall be on the road to teaching it better. In my view it is not the physiography that is "mere" but the geographers who merit this term in the sense that they are "hardly" geographers.

If the Association were to turn its back on research geography, there would indeed be small hope of engaging and retaining the interest and support of the university geographers. In justice let it be said that it was not the policy of Professor Fleure so to exclude it. He maintained an admirable balance in our journal. Moreover, since our present Honorary Editor brings, in my judgment, one of the finest research minds in geography in this country to his work I do not expect that research papers will in fact be excluded. We need not question of course that some such are more suitable and of more general interest than others and that our editor and editorial board have an incessant and onerous responsibility for choice. But never let us forget that if it is the status of our subject we would enhance then the doubt we have to meet is the one so widely held, whether we are in fact a subject in which real research—real widening of the bounds of knowledge—is possible outside the field of direct exploration.

But if I speak bluntly or even a little harshly of some of those who are not in my judgment furtherers of the status of our subject, let me in justice turn for a moment to the other versant of the dispute. To my university colleagues I would say that we owe the plainest of duties to support the Association for two good reasons. Firstly because our grammar school colleagues lay the foundations on which we build and secondly because, if we have any sense either of gratitude or historical perspective, we recognise in the Association the foster-mother of our own highly valued Institute. As Secretary of the Inaugural Committee of the latter I take leave to state that without the Geographical Association there would have been no Institute of British Geographers. The relationship of affiliation is as real as that of our own Association to the Royal Geographical Society.

But the difficulty at which we have glanced is, I believe, merely an aspect of a wider problem, that of the educational relations of our

subject. Since in what I am about to say I run a grave risk of misrepresentation may I preface my remarks by affirming that I have no doubt at all about the vital educational rôle of geography and the need of having it taught and well taught. If I sought in brief words to define our aim here, I should borrow a favourite phrase of my old chief Professor Rodwell Jones and say that it is our rôle to inculcate "an awareness of environment." I must not forget here the American colleague who informed me that he did not know what I meant by environment. I suspect that he was desiring to convict me of what has been canonized as a heresy in the view of orthodox American geography under the name of "environmentalism." I do not plead guilty to this charge and in case these words should meet the eye of the gentleman in question I will only say that if he would care for a few months to associate himself with the Joint School of Geography, we will teach him very quickly and unarguably what environment means.

I have no doubt too that the training given in the University Schools of Geography is as good an education as is given by any other subject, and better than most.

But I am disturbed at the contest between matter and method which goes on in Training Colleges and Training Departments. Summoning my not inconsiderable resources of rashness I will here and now accuse the "education people" of having been potent agents in diminishing the status of our subject and retarding its advance. It was after a depressing conversation with two training-college teachers at this conference that some few years ago I spoke at our own Institute of Education under the jeremiad title "Geography; is there any hope?" My theme was that the training colleges and departments were too little interested in geography itself in its full developing depth and scope and too preoccupied simply with methods of teaching it. I readily conceded to my friend Mr. Honeybone that the two things are not incompatible but I remain persuaded that a proper balance between them is often not kept.

This really takes us back to Mackinder's inaugural motion which I have quoted. Had I been present at that meeting with the views I have since developed I should have desired to point out that the improvement of the status and the teaching of our subject are two quite distinct though not unrelated tasks. No refinement of teaching artifice, no compilation, however shrewd, of tips and methods, will of itself convince the world of learning that we are a full and dignified discipline. For this we must look to the matter of our subject and its research progress. Do I, perhaps, exaggerate the antithesis here? If so it is at least a view based upon my own experience. I remember for instance my anger and mortification at being summoned to a Ministry course at Oxford to talk to teachers about the philosophy of geography, only to hear my class told before I had uttered a word that it really didn't matter very much what geography was or might be since their task was *not to teach*

geography but to teach "George." Thus was alliteration's artful aid applied in support of that most dangerous damnable form of heresy which is based upon a half truth. As one who is proud to have been a student of Sir John Adams, Sir Percy Nunn and James Fairgrieve, this amazing announcement so far as it contained any truth was not news to me. May I add that I am not willing to accept the customary gibe that my views are prejudiced by the inevitable outlook of a University Professor. That is the customary evasion of educationists when I seek to argue with them. May I therefore place on record that my first teaching of geography was to the 6th form in my own school and that I served a respectably long apprenticeship teaching in primary schools in both North and South London before my first appointment at King's College. And I remain to this day closely conversant with the problems and possibilities of grammar-school teaching through the work of my wife.

It is in the light of such experience and knowledge, as well as that derived from my present full-time occupation of training geographers, that I voice my grudge against the Training Colleges and Departments for failing too often to maintain the work of the Universities in clarifying and strengthening the aims and claims of geography as a subject. Let me refer to one other actual incident which has contributed to colouring my views. I was invited not long since to assist in the selection of a lecturer in geography at a well-known training college. The chairman of the interviewing board was a mature historical scholar. But he and I were unable to educe from most of the candidates any evidence that they were still very interested in the subject in which they graduated. They were manifestly all too interested in various rather cranky ideas and devices, visual or other, for the teaching of the subject. Most of them indeed were men or women with a mission with some brand-new teaching method to propagate. I was reminded of the remark of Canon Raven that psychology seems to obtain too much of its data from infants and invalids. I am happy to say that we appointed to the post the only man in the group who appeared still to be a geographer concerned with the advancement of his subject, rather than an amateur educational theorist.

The best summary of the position was contributed recently in conversation by my friend and old student Mr. C. L. Heywood: who remarked that the greatest obstacle to the better teaching of geography is ignorance of geography, i.e. the matter of the subject; not be it noted of "George" or of child psychology. In justice I note that this comment comes from the educational side of the fence, since Mr. Heywood is a Lecturer in Education.

Having reached this point of my address I paused to read what I had written and it seemed to me that I had so far adopted a rather complaining and querulous tone. I recalled that my friend and colleague Prof. R. O. Buchanan had contributed to *Geography* a paper

entitled "Some Grumbles" and I began to fear that this address might be more appropriately entitled "Some More Grumbles" and placed under the *nom de plume* "Gama" from Gilbert's *Princess Ida*. At this point therefore I seek deliberately to change the key, turning to the second part of my subject and attempting a more constructive approach. It will enable me also to rebut the possible charge of being inexcusably prejudiced against the study of teaching methods as such. I remain keenly and actively interested in field work methods in geography and I will even venture here to lay down the broad principles which I think should inform field teaching. I want here indeed to try to state as simply and definitively as possible what I conceive to be the proper aims and therefore methods in the teaching of field work in geography. To this extent at least, as I here avow, I am prepared to enter the field of the teaching method "cranks" and if the qualification for "crankhood" is to hold strong views on the matter I am both willing and able to join issue here.

All geographers no doubt acknowledge, in the sense of "pay lip service to," the importance of field work in their subject, but they show considerable doubt as to its objective and methods and pay far too little attention to it. This is partly no doubt because it is difficult to organize and conduct but I think it is also true that the wide scope of our subject tends to confuse the issue. To note the divergence of aim and method one has only to compare the practice of our now numerous University Schools of Geography on their regular annual field classes. In some cases this is little more than a sight-seeing tour, in others some form of detailed local investigation is attempted. For a few, field work in geography constitutes surveying and nothing more. We must in any case clear the ground by agreeing that field work cannot simply be equated with the sum-total of extra-mural activities. Visits to works, farms etc. are not in fact field work at all in the sense which I am here advocating it. I need hardly say that they have their evident place and value. My objection is that they so often take the place of real field work, since they offer an easy and lazy way out of a difficulty. Other people, commonly unpractised in the art, attempt to do the teacher's work for him, using a maladroit lecture method against a background of industrial or rural noise. It goes without saying that information thus gained, skilfully interpreted and placed in its proper context can be of high geographical interest.

In general, however, I submit that the object of field teaching, at least in the elementary stage, is to develop "an eye for country"—i.e., to build up the power to read a piece of country. This is distinct from, though plainly not unrelated to, "map-reading." The fundamental principle is that the ground not the map is the primary document, in the sense in which historians use that term. From this first principle I pass to a second that the essence of training in geographical field work

is the comparison of the ground with the map, recognising that the latter, at its best, is a very partial and imperfect picture of the ground, leaving it as our chief stimulus to observe the wide range of phenomena which the map ignores or at which it barely hints. In Britain we are admittedly favoured with an exceptionally full equipment of maps. We can generally bring together and compare at least the topographical, geological and land-use maps. To these are now being added the sheets of the Soil Survey. But even when all such material is synthesized it remains true that the ground will reveal innumerable significant details which the maps ignore.

This second principle carries a corollary so important that it is almost a third principle, viz. that the order of working is from the ground to the map and not vice-versa. It is rank bad teaching, to my view, to let a class occupying a view-point bend its heads over its maps, instead of concentrating on the work of looking and seeing. Let us say with Wordsworth:

> Enough of Science and of Art;
> Close up those barren leaves;
> Come forth, and bring with you a heart
> That watches and receives.

When leisurely observation is complete comparison with the map can fitly proceed. The reverse order too readily evokes the stupid and erroneous comment, Well what is the point of all this? It's all on the map anyway!

I need hardly add that it is inherent in the method and point of view I am commending that when in the field one should concentrate on observable field data. An easier but grossly incompetent method for the ignorant or unpractised is to deliver a roadside lecture of guide-book or text-book information borrowing freely but irrelevantly from history, geology or agriculture. The question is rather what can you see from here and more particularly what can you see which the map fails to portray. From this we can lead straight on to my last principle that the essential "doing part" of geographical field work lies in making significant additions to the map. This should be placatory to those of you who in conformity with one of the popular educational lunacies of our day are clamouring for "Activity." Much of what is urged and taught in this connexion appears to me ineffably silly, patently erroneous, and intellectually beneath contempt, but there is evidently here a place for *doing* and it is a first class exercise to "walk" a 1 : 25000 sheet annotating and interpreting it on the ground, making, that is, additions to the map. Broadly speaking I think these additions are at their best where, if they are not directly cartographical, they are at least graphical. To take one simple instance, it is a highly instructive and rewarding exercise to map a series of river terraces by putting on the map the breaks of slope which bound them. Nor is the exercise

"mere physiography." In lowland country, the lines drawn will be closely related to the land-use pattern. In upland country this will still be true and in addition significant light will be thrown on the siting of settlements.

I must not here dilate at length on possible exercises of this kind, but I have in fact done a better thing by persuading my friend Mr. Hutchings to exhibit at our Conference some of the exercises which he uses with school parties at Juniper Hall.

May I now turn back to the wider field of argument in which field work must be vindicated and reply to some possible objections. You may perhaps lament that the sort of work I have indicated is narrow and "local," implying that for that reason it is in some sense trivial. To this I reply with G. K. Chesterton that to make a thing real you *must* make it local and I am completely persuaded that geography begins at home. What we have to develop if we seek status for our subject is the art of seeing and using accessible local ground as a laboratory for our teaching. Though I flatly and forcibly reject the charge that what is local is trivial I can follow the mind of the objector; he is craving for our valuable and characteristic "world view," he is one of the geographical "Wesleys" who is claiming the whole world as his parish. This is well enough providing only that he does not try to run before he can walk. The test of a geographer young or old is in my judgment, not whether he is topically up to date in figures of world production, but whether he can interpret the full interest and significance of the "Little Lands" in Belloc's sense

> "The thousand little lands within one little land that lie
> Where Severn seeks the sunset isles or Sussex scales the sky."

Or as Professor East and I have ventured to remind our readers in the words of Blake:

> "Nature and Art in this together suit:
> What is most grand is always most minute."

It is here that we reach the core of the argument I am seeking to present. The road to the attainment of both of our objectives, the improvement of our status as a subject and our teaching of it, lies in the development of the laboratory spirit and the careful, indeed minute study of limited areas. I am well aware that this conclusion will be repugnant to some. But to some of my younger university colleagues with their appetites whetted by war-time travel I would say—we don't want your lumbering ram-shackle generalizations about major world areas such as the Far East, or the inter-tropical Belt. The difficult piece of integration which geography attempts must be vindicated on ground more accessible and manageable than this. I would recall that much of the best work of our pioneers in establishing

the subject and training its teachers was by way of the Oxford and London diplomas in the subject with their characteristic and valuable dissertation on a small area. Those Honours schools in this country which retain this method have something of the highest value which I hope they will not readily let go. It is in and by such studies that geographers are trained, not by encouragement to absorb and repeat the professors' dicta in the nightmare world of "geo-politics" or "world economic geography."

It is perfectly manifest, of course, that in teaching we have to solve the problem of balance between local and wider aspects and the high art is to use field work to illumine the wider field. This can very readily be done, notably in the field of physical geography. W. M. Davis quoted more than once these significant and forceful words from the preface of Huxley's *Physiography*:

> "I endeavoured to give them a view of the place in nature of a particular district of England—the basin of the Thames—and to leave upon their minds the impression that the muddy waters of our metropolitan river, the hills between which it flows, the breezes that blow over it are not isolated phenomena to be taken as understood because they are familiar . . . to show that the application of the plainest and simplest processes of reasoning to any one of these phenomena suffices to show lying behind it a cause which again suggests another until step by step the conviction dawns upon the learner that to attain even an elementary conception of what goes on in his own parish, he must know something about the universe."

There in clear and authoritative words is indicated the royal road by which careful local study can be projected as a searchlight beam into our wider universe of discourse.

And here too, unless I am much mistaken, lies the clue to the still unanswered problem, the devising of suitable geography syllabuses for the Secondary Modern schools. I should require these to be planted firmly and centrally upon local study.

But the "projection" of which I speak is not confined to physical geography. There are endless opportunities for applying the method of "comparative regional geography." For instance, a day in the Central Weald prompts a comparison not as might at first appear with the formal structural analogue, the Boulonnais, but if we consider soil, vegetation and human settlement, rather with the Argonne. In the same way South Wales affords us a comparison for Pennsylvania and the South Pennine area for the "Newer Appalachians." All this and more can arise easily and naturally from field work done in Britain providing it is done slowly, carefully and on foot on the lines I have already sought to indicate.

I am less enamoured of the practice of dashing around Britain or across Europe by charabanc. Before this can profitably be done, eye and mind must first be trained by field work of laboratory intensity. Otherwise the method too easily justifies Mephistopheles' sneer in Goethe's *Faust*

> "Are Britons here? They travel far to trace
> Renowned battlefields and waterfalls."

In conclusion may I also call attention to the opportunities for widening the bases of school field work by using the four centres of the Council for the Promotion of Field Studies. Juniper Hall, near Dorking, is our chief centre of geographical teaching by virtue of the signal laboratory facilities offered by the classic Surrey Hills and of the genius as a teacher of our Warden Mr. Geoffrey Hutchings.

The other three centres greatly extend the regional range. Malham Tarn House gives an introduction to the geography of the upland zone of Britain. Flatford Mill avails for an introduction to our distinctive eastern province and prompts many revealing analogues with the North European Plain, in Germany and Poland. Finally, Dale Fort in Pembrokeshire introduces the ria and plateau coast of the Atlantic zone of Britain and affords striking examples on accessible ground of the landscape imprint of two contrasted cultures—Celtic and Anglo-Saxon.

Speaking as the senior honorary executive officer of the Council I need hardly emphasize to this audience of teachers the advantages of ground already prepared and studied by our resident staff.

I am perfectly well aware that the greatest single obstacle to field teaching in geography is the shrinking of the teacher from his or her own ignorance of unknown country. All this the C.P.F.S. method is designed to cure. When my friend Mr. Francis Butler started the Council and founded our four centres he took, I consider, the most important step since the founding of our own Association, for the improvement of the status and teaching of geography. No grammar school boy or girl should complete his course without a visit to each of these centres. It is our aim and intention to develop the geographical side of our work at Malham, Flatford and Dale, to the Juniper Hall standard, and in guiding the educational policy of the Council I have proposed to the Ministry of Education that we should expand our activities so as to bring in the secondary modern schools.

At these centres you can consolidate your teaching under proper class-room conditions with the necessary equipment and expert local guidance provided. And if your work becomes linked or tinged with the Council's other main interest—biology—so much the better in my view for your geography.

You will not, I hope and believe, want to interject the false and futile "groan" that all this is not examination work. You would be

partially wrong even in fact but even more so in spirit. I have ventured already to quote the great Nature poet Wordsworth in support of my thesis. I will go further and essay a slight parody of famous lines thus:

One traverse in a Surrey Vale
(or if you prefer it, Yorkshire Dale)
Will teach you more of Man,
Of Man in his terrestrial home,
Than all the text-books can!

Postscript

Professor Wooldridge has requested that the following postscript should be added to his presidential address. (Ed.).

A typescript copy of my address was sent by request to *The Times Educational Supplement*. The extracts which appeared in that journal taken by themselves might suggest that I was chiefly concerned to make an indiscriminate condemnation of the work of training colleges and departments. Such indiscriminate condemnation would have been wholly unjustified for two good reasons. In the first place no university teacher could profess a sufficiently wide knowledge of such colleges and departments. But further, there is not the slightest doubt that a great deal of excellent work has been done in the field of teaching method in geography. I have no doubt for instance that it is much better taught at present than history. Let me say therefore with vigour and emphasis that I have no feeling of criticism and condemnation directed at teachers of "method" in general. And I should wish to add that within the University of London I have always been conscious of substantial concurrence in aims and emphasis with my colleagues of the Institute of Education, King's College and at Goldsmiths College. It is no less than a duty, too, to acknowledge also the excellent work done in the Colleges of the former Group II of the London Training College scheme (i.e. Furzedown, Stockwell and Whitelands Colleges). These, for many years, were the King's College Group and were known to me as their Group examiner. May I also pay tribute to the excellent work done in Environmental Studies by Southlands College.

If I were now asked how, in the light of the favourable testimony I here acknowledge, I can justify the criticisms I have made or implied I should reply that they are based upon the experience of my own students. Each session 20 to 30 honours graduates in geography leave us to complete their training as teachers in a wide range of departments. It would be unwise to take student re-action too simply at its face value but I cannot completely dismiss or discount the widespread frustration and disappointment which many of them feel as "method" progressively forces them away from the subject they have learned to love and respect and in which their intellectual capital is naturally and properly vested.

S. W. W.

The Vegetation of Blackdown, Sussex

A Study of Changes after the Cessation of Grazing

E. M. YATES

THE LOWER GREENSAND ESCARPMENT of the northern Weald gains height westward from Kent into Surrey, and beyond the River Mole reaches, in Leith Hill, 965 feet O.D., the greatest elevation in southeast England. Westwards the escarpment continues in Holmbury Hill and Hascombe Hill, and then turns abruptly south to Blackdown, where the westerly direction is resumed. The Hythe Beds, the division of the Lower Greensand formation responsible for each of the hills named, are of the order of 200 feet thick, and are composed of beds of the siliceous rock, chert, interspersed with sandstone and glauconitic sands. They rest upon the Atherfield Clay, which physiographically merges imperceptibly into the underlying Weald Clay. Blackdown, rising to 918 feet O.D., does not equal Leith Hill in height but is some 700 feet above the general level of the claylands. The abrupt swing of the escarpment at Blackdown (and Leith Hill), long a matter of debate[1], has with the headward and westward erosion of the Arun head-streams, had the effect of making the hill a flat-topped "peninsula." The "peninsula" is approximately one square mile in area, and rises steeply from the clay on three sides, connecting with the rest of the formation northwards (Fig. 1).

Blackdown today has a function which is largely amenity, but for several centuries, extending down almost to our own time, the hill was used as pasturage* with only minor cultivated encroachments, and there can be little doubt that this long continued grazing had a marked

➢ Mr. Yates is a lecturer in geography at King's College, University of London. The historical research involved in this inquiry was made possible by a grant from the Research Fund of the University of London. The field mapping, that constitutes the major (and the most arduous) part of the research work described, was carried out by a party of four, Miss P. M. Routledge, Miss D. Henry, Mr. P. Moth and the writer. Without the combined effort this work could not have been performed.

* The first direct reference to Blackdown is contained in a will of 1481, transcribed in *Sussex Notes and Queries*, vol. 8, 1940–1, p. 193, dividing the Manor of River amongst the co-heiresses of Sir John Pelham. The third heiress received as part of her portion "use or grazing of common pasture in a waste called Blackdown in Lurgashall late farmed to William Yaldewyn for four capons yearly." The Court Rolls of the manor, which are available from 1757 and are preserved in the offices of Johnson and Clarence, Solicitors, Midhurst, contain many references to Blackdown, including one to people grazing cattle thereon "without permission to do so." Grazing with Welsh bullocks and West Country sheep continued until the twentieth century, but appears finally to have petered out about the time of the first World War.

effect on the vegetation. The soils derived from the Hythe Beds in Surrey and Sussex are extremely poor sands. The coarseness of the constituent particles allows rapid downward movement of water, leaching of plant foods and a marked tendency towards the development of podsol profiles. The soils are very acid and much of the Hythe Bed outcrop carries today a heath flora, composed of plants tolerating acidic conditions. The heath communities of southeast England are however, sub-climax, maintained, Tansley suggests, by fires, grazing, and perhaps by a shortage of water; the true climax is oakwood (*Quercetum roboris et sessiliflorae*)[2]. The rainfall in the western Weald is relatively high. At Verdley, south of Blackdown on the clay, it is 37·5 inches; on the Hythe Beds scarps it is no doubt greater. Since Blackdown is difficult of access fires are most infrequent, and, as described, grazing has ceased. Thus all three factors which tend to perpetuate the sub-climax are absent. There should consequently be clear signs of reversion to oak forest, but the reversion has been complicated by man's introduction or re-introduction of species. The two of greatest importance on Blackdown are the Scots pine (*Pinus sylvestris* L.) and the rhododendron (*R. ponticum* L.).

The Scots pine appears to have suffered virtual extinction in southeast England as the oak advanced to dominance in Atlantic time,* and was re-introduced, in plantations, on a large scale, after the publication of Evelyn's *Sylva* in 1664. From the trees of such plantations the sub-spontaneous pines of southeast England are descended.† There are three possible sources for the re-introduction to Blackdown. First there were pine plantations close to the hill which are shown on the 1846 tithe map of the Parish of Lurgashall; secondly, also shown on the tithe map, there were ornamental clumps of pine above the southern slopes of the hill. It appears from the presence of a summer house and zig-zag path that the latter were planted when a small area in the south was landscaped circa 1800. The trees of one clump were felled in 1935, and were approximately 140 years old, which gives a corroborating date. Thirdly, as a possible source of re-introduction, there is reference in the Court Roll of 1792 to unlawful planting of trees on the "wastes." The "wastes", however, are not specified and Blackdown was but one of many in the Manor of River.

In order to investigate the amount of reversion from sub-climax heath to the true climax forest, and the part played by the pine in this process, the vegetation of the hill was mapped in 1948–9 (Fig. 2). In the mapping the vegetation was divided into the following categories:

* It is impossible to deny that some native trees may have survived in isolated areas. Recorded instances of indigenous pines are discussed by H. J. Elwes and A. Henry, 1906.[3]

† The earliest reference to plantation of Scots pine ante-dates *Sylva*. It occurs in a letter from James I to the Earl of Mar, dated 30th October, 1621, asking for pine seedlings for the Marquis of Rockingham for his estate at Burleigh on the Hill. Details of this letter are given by H. J. Elwes and A. Henry, *op. cit.*

heath, bracken, wood, and scrub. It is important to add a few points on each of these categories.

Heath: In the areas mapped as heath, ling (*Calluna vulgaris* L.) was dominant in close association with bell heather (*Erica cinerea* L.). Bilberry (*Vaccinium myrtillus* L.) was abundant, and most of the area was dotted with furze or gorse (*Ulex europeaus* L.). Tormentil (*Potentilla erecta* L.) and the cross-leaved heath (*Erica tetralix* L.) were frequent, the former mostly near the paths, and often with wavy-hair grass (*Deschampsia flexuosa* L.).

Bracken: Here bracken (*Pteridium aquilinium* L. Kuhn.) was dominant. It must be pointed out that heath plants occurred occasionally in the bracken area, and vice-versa, but the division between the two was remarkably distinct. Bracken also occurred as a ground layer beneath the scrub and wood.

Scrub: The dominant plants were young Scots pine (*Pinus sylvestris* L.) and silver birch (*Betula verrucosa* Ehrh., formerly *Betula alba auct.* L.), with occasional rowans (*Sorbus aucuparia* L.) and white beam (*Sorbus aria* L.), intermixed with furze, the whole forming a tangled and sometimes impenetrable mass of vegetation. There was usually a lower layer, chiefly bracken, sometimes associated with blackberry (*Rubus spp.*).

Woodland: In the regions to which this term was applied, the vegetation consisted of mature trees, in closed canopy. The trees present, listed very approximately in order of frequency, were oak (*Quercus robur* L. and *Quercus petraea* Mattuschka),* beech (*Fagus sylvatica* L.), holly (*Ilex aquifolium* L.), silver birch (*Betula verrucosa* Ehrh.), Scots pine (*Pinus sylvestris* L.), rowan (*Sorbus aucuparia* L.), ash (*Fraxinus excelsior* L.), yew (*Taxus baccata* L.), and white beam (*Sorbus aria* L.). The ground flora varied with the density of shade, almost non-existent beneath the stands of yew, holly and beech, in other areas bracken and blackberry.

The division between woodland and scrub was usually distinct; it was quite often the division between old planted woods, marked off by earthen embankments, and the self-sown colonization areas. But the division was on occasion made with difficulty, and the subjective element increased. A similar difficulty occurred in deciding where the scrub gave way to either of the first two categories. In both the heath and bracken areas small thriving seedling trees occurred—pine and silver birch, and once more the subjective element increased. The possible error, however, was a matter of a few yards, and would not fundamentally alter the map.

* Formerly *Quercus sessiliflora* Salisbury.

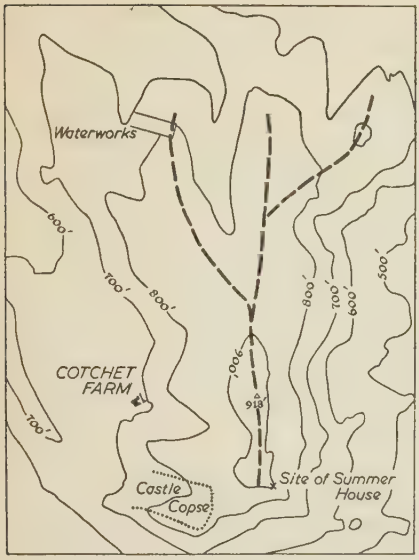

Fig. 1.—Blackdown, relief. Vertical interval, 100 ft.

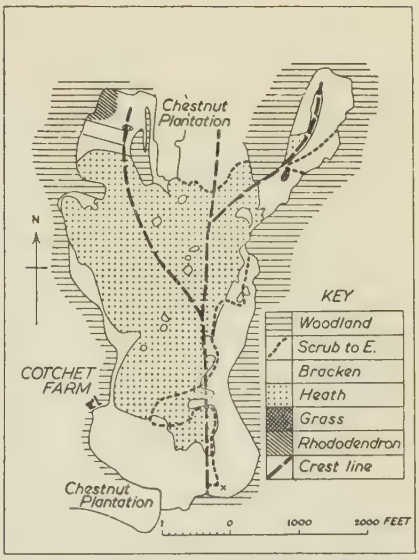

Fig. 2.—Blackdown, vegetation 1948–9.

As can be seen from the map, the vegetation pattern consisted of a central core of heath, surrounded by an inner incomplete ring of bracken and an outer ring of woodland. In addition, in the east, extending from the woodland up the slopes and occasionally crossing the bracken into the heath, was a zone of scrub. The western boundary of the scrub is indicated by a dotted line, and, between this boundary and that of the woodland, the bracken or heath (as mapped) formed the lower layer beneath the young trees. The central core of heath did not exactly occupy the top of the hill however; it was offset to the west (the crest line is indicated on Figs. 1 and 2).

Indeed the vegetation of Blackdown was an object lesson in the effects of exposure. The heath plants, with reduced leaf surface, withstood the exposure better than the bracken. The bracken, with large leaves and thin cuticles, suffered more in exposed positions. Despite this an increase in the areas dominated by bracken was testified to by the local inhabitants, and their testimony was supported by evidence gained in a visit to a small shoulder some three miles north of Blackdown. This feature, also formed by the Hythe Beds and orientated similarly to Blackdown, was mapped by Fritsch and Parker some thirty years previously.[4] A comparison of their map with the distribution of the communities in 1949 showed a dwindling core of heath and an extended area of bracken.

Jefferies has shown that the success of the bracken plant is due to its ability to shade out competing plants,* and to a toxin released by

* Competition between the bracken and heath was formerly prevented by (i) cutting the bracken to provide bedding for cattle, or simply to keep it under control, (ii) treading of the bracken by cattle when the hill was grazed.

the decaying fronds.[5] Under living fronds he found that the light had one-twentieth of its intensity in the open, under dead fronds the light fell to one-fortieth of its intensity in the open. This light intensity is insufficient for the requirements of ling (*Calluna vulgaris* L.); *Deschampsia flexuosa* L. can survive such a degree of shading, but succumbs to the toxin. It would appear therefore that, in order to extend its areas of dominance, the bracken must exceed the height of the competing plants (in order to smother them with dead or living fronds) and this it cannot do in exposed areas, for any fronds projecting above the general level of vegetation would be killed. The generally uniform level of the bracken and heath areas was an outstanding feature both on Blackdown and on the small shoulder mapped by Fritsch and Parker.* Individual bracken plants were found scattered in the heath areas† but they did not exceed the height of the heath community. Smothering can only be achieved when the bracken is protected from the wind. Of the other factors operative in competition between bracken and other plants it is to be noted that bracken is usually avoided as a food by rabbits. This is very much in the favour of the bracken plants in a rabbit-infested area, when the bracken is invading heath or grass on which rabbits browse freely. On the other hand bracken is very sensitive to frost (Watt states that 79 per cent of the fronds and 44 per cent of the rhizome apices, in the Breckland area to which his work relates, were killed by frost in 1940).[7]

This must make the invasion by bracken of frost hollows and low-lying ground difficult, despite the probable advantage of dampness facilitating the sexual reproduction of the plant.

On the west-facing slopes of Blackdown the bracken fronds were protected from the prevailing wind by their fellows to the west, and it appeared that, since the height of the foremost fronds was controlled not by the heath (to leeward) but by the bracken fronds to the west and ultimately by the trees, advance was possible. The height of the fronds decreased from six feet beneath the trees (isolated fronds of eight and nine feet were noted) to approximately one foot at the bracken-heath junction. Watt has described invading bracken in the Breckland as wave-like, since the height of the fronds reaches a maximum some distance away from the junction line and then falls away.[8] He considers that the height of the frond is primarily related to its position on the plant as a whole, and that a wave-like form in frond height results from a series of long invading rhizomes lying normal to the junction of the bracken and the invaded community. But the observations were made in gently sloping areas, and the factor of exposure cannot have

* "A striking feature is the very uniform level on the top of this Calluna zone. This appears to be due to the fact that the projecting tips which grow beyond the level of the surrounding growth tend to dry up and die away." F. Fritsch and W. Parker, *op. cit.* p. 153.

† Probably sexually-produced plants where sufficient moisture was present in the ground for the germination of the bracken spore and the development of the prothallus. The main invasion of the heath areas is, of course, vegetative—by rhizome. For conditions governing the development of the prothallus, see Miss E. Conway, 1949.[6]

been so important as on Blackdown where no wave form was observed. On the eastern face of Blackdown the bracken was protected from the prevailing westerly wind by the mass of the hill, and this must have facilitated its advance. Once the crest was attained however further advance would have been in the teeth of the prevailing wind. The height of the bracken plants at this junction was controlled by the heath (to windward) and the advance must have been greatly retarded.

From the above data it is suggested that an invasion of a hill (with this orientation) by bracken follows a certain pattern. Initially there should be a rapid conquest of the heath on the sheltered slopes, the heath-bracken line stabilizing on the crest, and a gradual reduction of the heath area by an advance of the bracken up the exposed slope. On Blackdown the position in 1948–9 was one in which the rapid conquest on the east was all but completed, and the gradual advance on the west was in progress.

The simple distribution shown on the 1948–9 map (Fig. 2) was marred by isolated areas of bracken, some of which seem to be indicated as growing on the most exposed portions of the hill. In fact these areas are local hollows. Stone was formerly dug on Blackdown, both for road metal and for building purposes,* and it was to the shelter afforded by the shallow pits left by the stone-workers that these isolated bracken communities owed their survival.†

Any short traverse up the eastern slopes of Blackdown passed through an area of mature woods followed by a scrub region with trees of decreasing age until the bracken or heath was reached. Even on the heath seedling trees were struggling for survival. All the evidence of the ground testified that an invasion by trees was in progress. Cartographic evidence is more difficult to obtain. The distribution of trees symbols on the 1st Edition of the O.S. 6-inch sheets (surveyed 1873) appears to indicate that a marked extension of scrub has taken place around the southeast of Blackdown near the site of the summer house, but it is unwise to place too much reliance on the use of symbols.

The maximum extension of the scrub, like that of the bracken, was on the east and this suggests that the two are related. It was not solely a matter of exposure since, as noted, pine and birch, isolated or in clumps, were growing on the crest. It may be that the distribution of parent trees played some part (the pine clumps, near the site of the summer house, were close to the maximum extension of the scrub), but there is also to be considered the effect of bracken on the soil. There appears to be little evidence that bracken increases podsolization. Indeed it is not inconceivable that the reverse may be true. The rhizomes may well penetrate and break up any accumulation in the B horizons, and, by the heavy annual fall of fronds, return valuable

* The Court Rolls refer to unlawful digging of stone on Blackdown.

† Dampness in the pit no doubt facilitated the development of the prothallus and completion of the sexual reproduction of the plant.

nutrients to the surface if the rate of decay is rapid. Pickworth Farrow noted (in Breckland) that ling (*Calluna vulgaris* L.) rooted between 5–15 cm. whilst the bracken rhizomes were at 25 cm. down.[9] Haines, working in the same area as Fritsch (Hindhead Common) found a tendency for the pH values to decrease in the valleys save where bracken and gorse were present. "It is significant that in the three cases where the valley was found to be less acid, the base of the slope was occupied by a special zone of *Ulex europaeus* and *Pteris*."[10] In the pH values given by Heath and Luckwall in their study of the rooting system of heath plants growing in the Mendips the highest values were from bracken areas.[11]

It is possible therefore that an invasion of heath by bracken may be accompanied by a rise in the pH value. Such a rise would generally (though not invariably) indicate an improvement in the soil since in very acid soils the activities of nitrifying bacteria are restricted, and iron and aluminium are most mobile, fixing any phosphates present in forms which make it unavailable to the higher plants.

This is not to suggest that the succession is heath, bracken, birch and pine, oak; but if the bracken retards podsolization it may well assist the oak to colonize. Tansley mentions that podsolization may possibly render oaks incapable of successful establishment.[12] On the other hand, if the bracken is too dense it is unlikely that trees could establish themselves, but this did not appear to be the condition on Blackdown. Tree seedlings in the bracken area were numerous. In contrast to oak, pine not only invades podsols but actively increases podsolization. Water which has seeped through a litter of pine needles has an increased ability to translocate iron compounds.[13] Herein lies the importance of the re-introduction of Scots pine, for it makes it increasingly difficult for the oak to re-establish itself. Birch, however, does reduce podsolization; it has a restorative effect, recreating a brown forest earth from a podsol.[14] There are, it is suggested, a number of possible successions:

(1) heath → pine (i.e. podsol → podsol).
(2) heath → bracken → oak (i.e. podsol → brown forest earth).
(3) heath → birch → oak (i.e. podsol → brown forest earth).

It is to be noted that where the birch or the pine invade the heath they probably assist the bracken by giving it cover from the wind, but the shade would prevent the bracken achieving the same profuse growth as in unshaded areas not exposed to the wind.

The problem of the succession is further complicated by the appearance of the rhododendron. On the west face, north of the waterworks enclosure, the plant rose to dominance, and to all appearances colonization was proceeding apace. Some of the individual plants covered considerable areas, replacing the bracken which was elsewhere dominant (for north of the waterworks enclosure the face of the hill drops steadily in height, and heath disappears save on the very crest).

The success of this introduced plant is of great interest, and the rhododendron is to be met with under similar conditions on many of the southern heaths. East of the area on Blackdown where the rhododendrons were most frequent, they had been cultivated as an avenue, and here were the parent plants.

The botanical problems unsolved are many: for example, the very marked western extension of the scrub of the east face towards the Cotchet Farm valley; the effects of bracken on the soil and the colonization by oaks; and the part played by the pine. In the last it is of importance that the introduction of the parent trees can be approximately dated and the spread of the pine measured against time. Remapping Blackdown after a period of years will help to elucidate many problems, but the evidence is sufficient to show clearly that the landscape of this small area of Sussex has been and is experiencing a period of relatively rapid change. It can be further stated that Blackdown is no isolated example. Over much of the Hythe Beds outcrop recolonization by trees is taking place, and it is suggested that the date of the cessation of grazing may provide an explanation for the various stages reached in recolonization on different parts of the outcrop, such as the almost complete tree cover of much of Leith Hill compared with extensive areas of heath remaining on Blackdown.

Further, such changes are not restricted to the Hythe Beds. Many commons on the Folkestone Beds outcrop and on the Weald Clay outcrop are now little used for grazing, and are progressing towards a condition similar to that of the Broadbalk Wilderness of Rothamsted (the part of the Broadbalk Field left untouched since 1882 and now a young wood).

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Changes in the Geography of Electricity Production in Great Britain

E. M. RAWSTRON

As a result of the construction of the new Supergrid* (Fig. 1), which should be in full use by 1960, it will be possible, for the first time in Great Britain, to transmit large amounts of current over considerable distances. No longer will local, or at most, regional self-sufficiency in generation be the inevitable rule throughout the country, as it was under the original, small capacity grid.

The purpose of the new Grid is two-fold. It is intended, first, to provide for the export of base-load current from stations on the Trent into southern England and South Lancashire, and from stations on the Aire and the Calder in West Yorkshire into Lancashire. Secondly, it will provide the much greater interconnection capacity which is required now that the output of current is so much larger than before the war.†

In accordance with this scheme, very large increases in generating capacity are being undertaken or are envisaged on the banks of the Aire and the Calder and especially the Trent. The increase on the Trent gives rise to the greatest change in the geography of electricity production in Great Britain since supplies became generally available over the country as a whole. Fig. 2 shows well the projected concentration of new plant on the river.

This change in locational policy is chiefly the result of two important new considerations. First it was expected until recently that the thermal efficiency of generating plant was rapidly approaching its maximum. Thus no further large economies could be expected in future from

➤Mr. Rawstron is a lecturer in geography in the University of Nottingham. His article presents a summary of the additional material which has become available since his earlier article in *Geography*, vol. xxxvi, 1951, pp. 249–62.

* The new Grid will have a total export capacity of 3,000 MW., about half of which will be available for planned, regular exports. This amount (1,500 MW.) is slightly over one-third of the present national base-load in winter.

† Interconnection provides for the pooling of spare plant throughout the country. It is particularly useful in case of breakdown and to adjust local and regional deficits and surpluses. These vary from hour to hour according to such factors as local habits and weather conditions. It also allows production to take place increasingly at the more efficient stations. For long the old grid has been inadequate for these tasks.

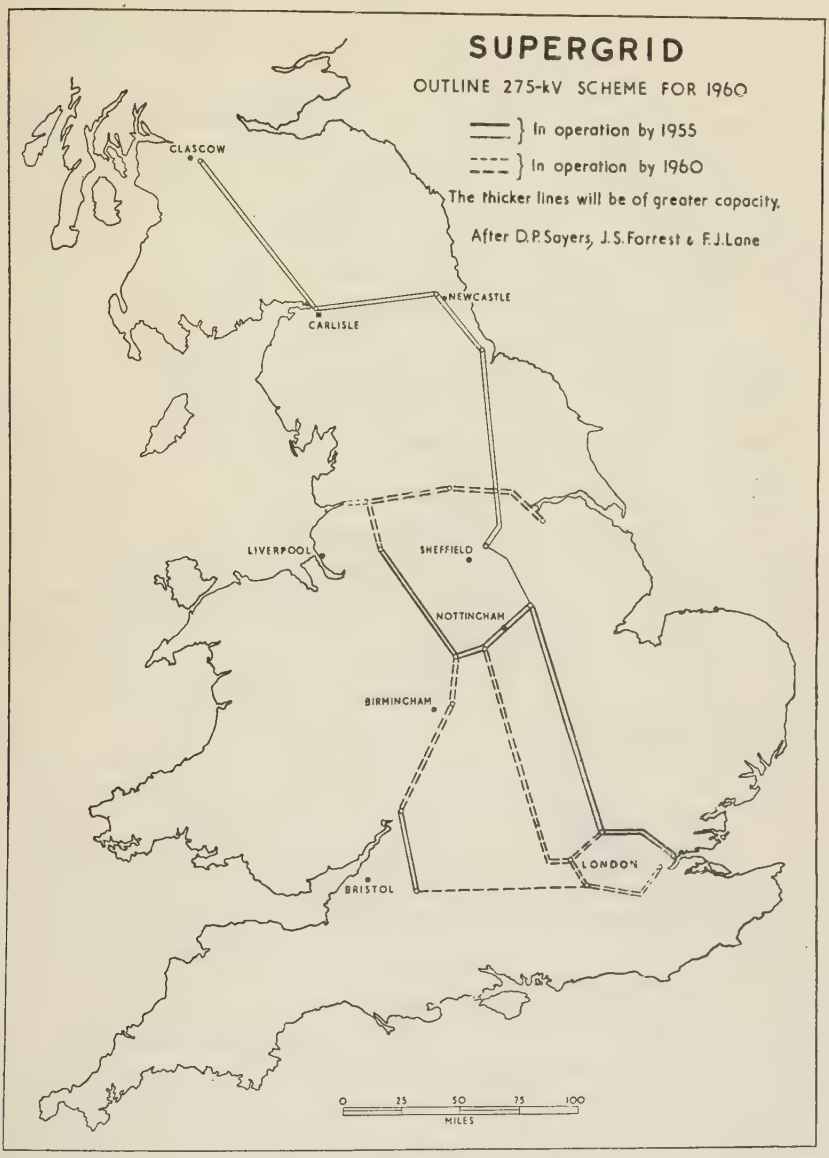

Fig. 1.

reduction in coal consumption through improved plant design,* and comparatively small economies obtainable through certain locational improvements were therefore deemed worthwhile. Indeed, if progress in technical efficiency at the plant ceases, then location is

* i.e. economies which derive from lower coal consumption on the part of newer plant. The pit-head price of coal, it will be remembered, comprises over 60 per cent of the works costs of production. The expected cessation of advances in plant design has been proved false at least for the next ten years by subsequent developments. Whereas thermal efficiencies of about 30 per cent were thought in 1950 to be the likely future maximum, 36 per cent is now considered attainable. Nevertheless the firm expectation of 1950 undoubtedly affected the planning of the new locational policy and the Supergrid.

the only field left for economy. Secondly the demand for electricity has increased so much since 1939, and continues to do so, that coastal coalfields are unlikely to be able much longer to supply enough fuel for coastal and estuarine stations in southern England to be greatly expanded. This has two effects, more coal must be supplied from the interior coalfields for electricity generation and steps are being taken to equip coastal plant to burn oil should coal supplies become inadequate. Marchwood on Southampton Water is to be the first of these dual-fired stations but others around the coast and on the lower Thames are likely to be similarly equipped.

Both the recent expectation of the attainment of maximum efficiency in plant design and the shortage of coastal coal implied that locational policy had to be reconsidered with a view to achieving further economies in costs of production and marketing. These relate mainly to economies in transport costs for both fuel and electricity, and to a less degree, to costs of cooling and ash-disposal.

Transport costs are a complex factor, but the situation may be summarized as follows: water transport is cheapest over any considerable distance: transmission of current is cheaper than rail transport over distances greater than 40–50 miles, provided that base-load current only is transmitted. Mid-load and peak-load current is more costly to transmit and generally will be produced as near as possible to the major consuming centres.

Cooling and ash-disposal costs are lowest generally at the estuarine or coastal site. The next best is to be found on the larger rivers at points where ample space is available for ash-disposal.

As a result of these considerations, a re-organization of the electricity generating industry is currently taking place. When the new Grid is completed, instead of the almost wholly local production of electricity to supply the local market as at present, the following will be the broad outline of the system.

(1) There will be two base-load exporting areas, namely the Trent Valley and West Yorkshire (the Aire and Calder Valleys). These lack adequate water transport in the right directions and therefore it will be cheaper to transmit current than to transport coal. They possess surplus coal supplies from the expanding and comparatively low-cost coalfields nearby and much of the coal produced (especially in the East Midlands division of the N.C.B.) is suitable only for heat-raising. Cooling costs are somewhat higher on the Aire and Calder than on the Trent, but ash-disposal costs are reasonable at the sites chosen.

(2) South Lancashire and the inland areas of southern England (parts of south-western England are probably included too) will import some of their base-load current.

The declining output of the Lancashire coalfield is inadequate for local demands, and there are no suitable water links with either the

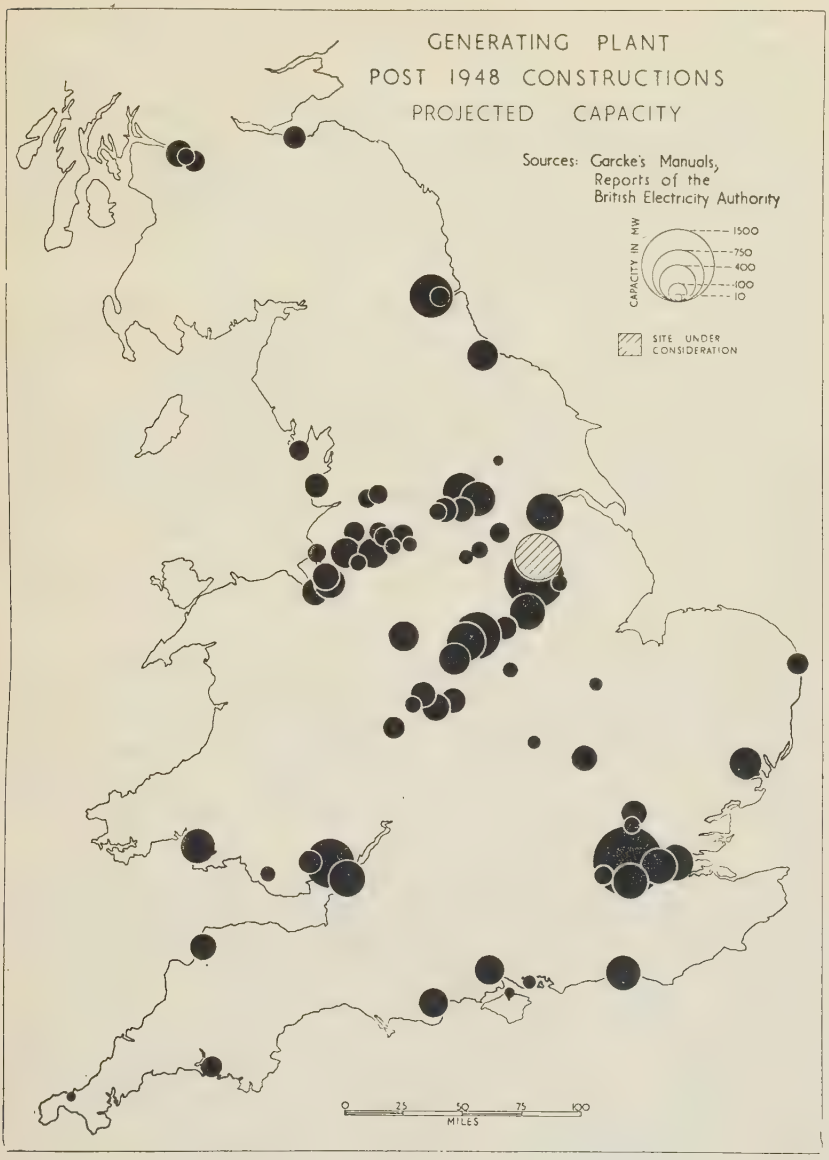

Fig. 2.

East Midlands or West Yorkshire. Hence the import of base-load current is planned. Much new plant is, however, being established in South Lancashire and North Cheshire, and it must not be assumed that anything approaching the whole of the base-load will be imported. The area is too near the Yorkshire coalfield for the maximum advantage to be obtained from transmission. Furthermore the heavy mid-load and peak-load demands must still be supplied from local stations, and

the absolute increase in the peak-load is almost four times that of the base-load.

The inland areas of southern England have neither good water transport nor local coal production. Here is a clear field for transmission. It is probable too that this importing area includes the western and northern outskirts of London to some extent, and may extend almost to the South Coast; for there is evidence that much of the new capacity near London and on the South Coast is intended for mid-load and peak-load operation.

(3) South Wales and Northeast England will be self-sufficient in electricity production but will send coal* mainly by sea, especially to coastal generating stations elsewhere in the country.

In my earlier article, it was wrongly stated that the great increase in capacity in South Wales was probably intended to supply other parts of the country. This view must now be revised. The new stations in South Wales will certainly supply a wider area than South Wales, but most of the increase is undoubtedly planned to cater locally for the growing industrial demand and for an increase in domestic consumption. The latter is well below the average per capita for the country as a whole.

A broadly similar argument applies to Northeast England.

(4) Inner London, and limited coastal areas in eastern and southern England, will be self-sufficient. Water transport is adequate and coal can be brought in more cheaply by sea than electricity can be transmitted from stations on the coalfields, and should coastal coal become inadequate oil fuel can be substituted, possibly at advantageous rates to those stations near the large refineries.

(5) Central Scotland will be largely self-sufficient, but will import some peak-load and later, base-load current, from the North of Scotland Hydro-Electric Board. Hence the comparatively small increase in capacity in central Scotland (see Fig. 2). This is, however, too large a topic to be examined here in greater detail.

(6) In the West Midlands, the situation is rather more complex than elsewhere. The Severn is neglected in the new scheme because it is too far from both coal and market. Capacity on the Birmingham plateau is being increased in keeping with the policy of locating mid-load and peak-load stations as near as possible to the market. Base-load current will be supplied mainly from Hams Hall (nine miles east of Birmingham) augmented by the nearer Trentside stations. Drakelow (near Burton-on-Trent), although in the East Midlands Division of the British Electricity Authority, is in fact being constructed by the Midlands Division which has its headquarters in Birmingham.

It should be stressed that since the increasing mid-load and peak-load supplies are still to be generated locally, most of the installed capacity

* Northumberland coal is supplied to stations along the East Coast and the eastern half of the South Coast. South Wales supplies the coastal stations in south-western England.

must still remain close to its market. Only in the East Midlands are really striking changes apparent between the 1948 and post-1960 positions.* Other major changes emerge through statistical analysis, and are not immediately visible on the maps of this and the earlier article. It is impossible to give a fuller interpretation here, but it is hoped that this summary will help to clarify at least the broad outline of the present developments and their geographical manifestations.

* cf. Fig. 2 in the present article and Fig. 1 in my earlier article.

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Chepstow: A Defunct Seaport of the Severn Estuary

J. H. ANDREWS

IT IS A COMMONPLACE of English historical geography that despite the general economic expansion of the last two centuries many of our smaller seaports have languished and declined. A good deal of information is needed for the full understanding of such changes: a port may shrink in population, extent, or function; its functional decay may embrace either commercial or non-commercial activities; decline may be absolute or relative, recent or of long standing; it may be shown in the volume of trade or its value, in the number or the size of ships using the port or belonging to it, in the geographical extent of its trade connections, or in the range of commodities handled. Considered in these terms, the subject of port decay seems to have attracted no more than superficial attention, and it would be difficult to find an English port whose decline during the last two hundred years has been measured, dated and adequately explained. One reason for this neglect is the bewildering variety and complexity of English trade statistics, which almost give the

➤ Dr. Andrews is a member of the staff of the Geography Department at Trinity College, Dublin. He wishes to thank Mr. Ivor Waters, Honorary Secretary of the Chepstow Society, for generously putting at his disposal a large quantity of historical material collected from local newspapers, guide books and directories.

impression of having been designed to frustrate any attempted comparison of the state of a port—especially a small port—at two different periods. It is hoped that the following remarks, besides contributing to the problem of port decay in a specific case, may serve as a preliminary guide to the sources for such inquiries.

Chepstow, sometime commercial focus of the Wye Valley, is an appropriate subject for a study of this kind: with its filled-in dock and deserted slipways, its half-dozen derelict warehouses and its single life-belt, this is a good example of a "fossil" port: only the trade is missing. Chepstow began as a bridge-and-castle town controlling what was until the sixteenth century the only crossing place on the lowest twenty miles of the River Wye (Fig. 1) and its commercial connections with a large hinterland originated with the improvement of the river in the late seventeenth century. Ships of 700 tons could anchor near the town at low water and the incoming tide, which brought another forty feet of water up to the bridge, carried forty-ton vessels as far as Monmouth, despite the numerous weirs which salmon fishermen had laid across the stream. In 1662 Parliament provided for uninterrupted navigation between Hereford and Bristol but this Act was not put into execution until the end of the century; thenceforth ships of 100 tons were able to reach Brockweir and thirty-ton barges penetrated to Hereford.[1] The Wye was fortunately placed in the England of 1700: below Ross it flowed between steep slopes of limestone and conglomerate, unproductive agriculturally but rich in iron, timber and water-power; above Ross the river traversed a region chiefly concerned with corn, wool, fruit, cider and hops, with its centre at Hereford, then the largest town west of the Severn. Chepstow, at the mouth of the river, was situated, as it were, at the head of an arrow pointing straight at Bristol, the second largest urban market and distributing centre in England. The Wye navigation suffered from several disadvantages, however, although these did not become apparent until a later stage of its history. The Herefordshire stretch of the river could never be relied upon: it was too shallow in an average summer and in winter its flow became dangerously rapid. Throughout the river's length meanders made transport slow and expensive and the rocky, gorge-like character of its lower course made it difficult to straighten or deepen the waterway.

Chepstow's trade during the extension of the Wye navigation is recorded in the Port Books.[2] Between 1662 and 1719 (the date of the last surviving Chepstow Port Book) the port passed rapidly through three phases. In the first phase, which ended in the 1690s, the Wye Valley iron industry supplied most of the traffic.[3] Apart from a small and declining trade in iron ore to Wexford, Wicklow and other Irish ports, shipments of iron amounted to about 1,300 tons per year. Pig iron was sent to Newport and other South Wales ports and bar iron to Bristol and Gloucester, while small quantities of special high-quality

Fig. 1.—Site of the town and port of Chepstow. The whole of the area between the railway and the western bank of the river is now occupied by the works of an engineering company.

"Osmund" iron were brought from Newport for the famous Tintern wireworks, whose product was exported chiefly to Bristol. The importance of the Wye navigation is even more clearly shown by the development of the copper trade. Neither the market nor the raw material for copper smelting was to be found here, although a small local ore deposit, soon exhausted, may have occasioned the foundation of the industry at Redbrook in about 1690. Imports of ore from Truro and St. Ives rose in ten years from 50 to nearly 1,000 tons a year, although exports of smelted copper remained small.[4]

The improvement of the river above Monmouth inaugurated a second phase, in which large quantities of corn, cider and hops were shipped from Herefordshire to Bristol: annual average corn exports

rose from about 100 quarters in the 1670s to 6,000 quarters in the 1690s. The third and longest phase began with the rapid expansion of the bark trade. Exports of oak bark for the Irish tanning industry appeared suddenly and almost simultaneously at many ports in England and Wales, but Chepstow soon took the lead. The bark was drawn from the woodlands along the lower course of the river, much of it being pared and cleansed for shipment at Monmouth. Exports increased from nothing in 1713 to over 700 tons in 1718.[5]

The import trade of the Wye was relatively small at this time. Besides copper ore from Cornwall the chief items were tobacco, wine, sugar and general merchandise from Bristol, salt and clay from Gloucester, a few cargoes of coal each year from Swansea or Newport (Chepstow was never wholly supplied from the Forest of Dean coalfield) and an occasional shipment of hides, skins or barrelstaves from Ireland. To what extent this traffic was fostered by facilities for inland navigation may be judged by comparing the Wye with the Usk, navigable to Caerleon, and the Taff, which was not navigable above Cardiff. The following table and Fig. 2 show the insignificance of Newport and Cardiff in the seventeenth and eighteenth centuries.

Numbers of Outward Shipments

		Chepstow	*Newport*	*Cardiff*
To Bristol	(1683) ..	63	49	44
„ other English ports	„ ..	42	3	5
„ Ireland	(1684) ..	47	—	—
„ foreign ports	„ ..	1	—	4

(*Exch. K.R. Port Books* 1281/14 & 21; 1282/1 & 3)

Chepstow seems to have attained the peak of its prosperity between 1790 and 1830. Its status as an independent Customs port, first granted in 1700,[6] was confirmed in 1823,[7] when three legal quays were appointed for the transaction of foreign trade; bonding facilities were provided for timber in 1830 and for wine in 1838, while since 1759 there had been a graving dock accommodating vessels of up to 500 tons. Barge traffic was still flourishing on the Wye, which was now navigable to Hay in Brecknockshire, and a new towpath Act was passed in 1809. Apart from the staple exports of bark, timber, iron and corn, several local industries now contributed to the commerce of the port. Tinplate had been made at Lydbrook, Gloucestershire, since 1760, and thirty years later the Redbrook copper works were converted to tinplate. By the end of the eighteenth century Chepstow itself possessed two brickworks, a glass factory and a bell foundry; locally-made rope was exported for the use of the navy, and old rope supplied the raw material for the half-dozen paper mills working on the Mounton Brook to the west of the town. The most important industry of this period, however, was shipbuilding at Chepstow and Brockweir, producing vessels of up to 700 tons for the Baltic, African and East India trades.[8]

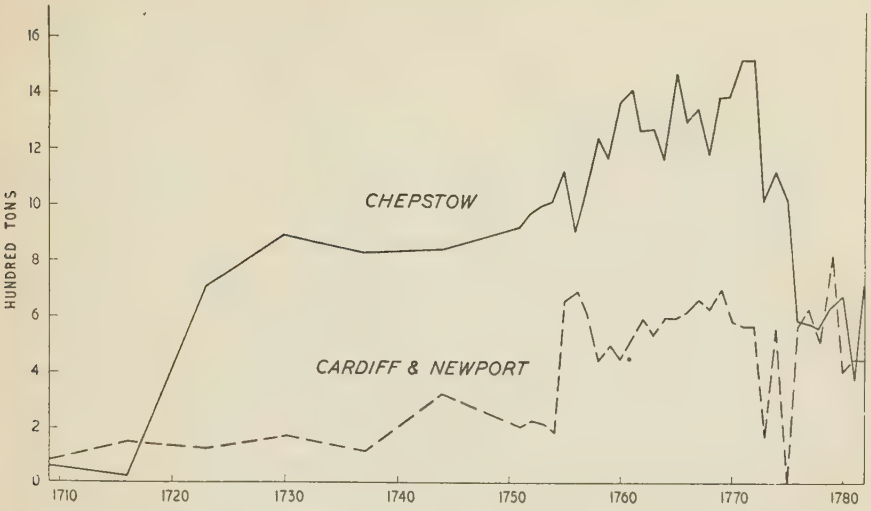

Fig. 2.—Merchant shipping, 1709–82 (Brit. Mus. Add. MS. 11255). The figures refer to the annual volume of shipping engaged in coastwise and foreign trade, counting each vessel once only. Figures for 1709–51 are available only at seven-year intervals. Together with Add. MS. 11256, which gives the tonnage of shipping inwards and outwards in foreign trade for 1709–79, these are the only shipping figures for the mid-eighteenth century. The MS. States of Navigation, Commerce and Revenue (P.R.O. *Customs*, 17) gives the shipping registered at each port in 1772–1808 but contains no details of the actual flow of trade.

Shipping statistics for this period were obtained from the Inspector-General of Imports and Exports by a contemporary observer, Archdeacon William Coxe.[9]

Annual Average Volume of Shipping (with cargoes)

		Inwards		*Outwards*	
		Ships	*Tons*	*Ships*	*Tons*
Coastwise	(1791–7)	388	23,345	497	30,634
Irish	(1791–4)	13	1,355	110	8,484
Foreign	(1791–4)	14	2,537	2	395

Coxe also gives very full details of all foreign (including Irish) imports and exports. The chief exports were oak bark (4,271 tons per year), iron of all kinds (598 tons) and timber (317 tons), while minor exports included glass, bricks, millstones, grindstones, hoops, cider, apples, hops, rope and paper. Foreign imports included small amounts of wine, corn, bar iron and Irish linen, but the most important items were shipbuilding materials—timber, deals, hemp, flax, pitch, tar, tallow, oakum and sailcloth. About 2,000 tons of shipping, both in Coxe's time and twenty years later,[10] entered each year from Russia, Prussia and Denmark.

Coxe's figures show that, like many small harbours situated within a few miles of a major port, Chepstow possessed very little foreign commerce even in its most active period. This characteristic of its trade did not favour future expansion, for the usual nineteenth-century trend in English seaports was an increase in foreign trade while

coastwise trade stagnated. For the time being, however, the proximity of Bristol across the Severn brought a flourishing coasting traffic; in 1792 two coasters sailed each week from Chepstow to Bristol, and on every spring tide five Bristol trows went to Tintern, three to Llandogo, two to Monmouth and one to Hereford.[11] Fig. 3 shows the direction of Chepstow's trade in four sample weeks of 1833. By this time the bark trade had expanded to embrace southern England, South Wales and Scotland; Coxe gives the coastwise bark exports as 2,000 tons. Outward shipments of timber, which reached a maximum during the Napoleonic wars and then declined, went chiefly to the naval dockyards of Plymouth, Portsmouth and the Thames: in 1811 no less than sixty ships, totalling 8,762 tons, left the Wye for English ports beyond Lands End, the tonnage for London exceeding that of every west-coast port (including Bristol) except Cardiff and Liverpool. The coastwise corn trade also continued on a large scale, sometimes reaching more than 30,000 quarters a year: in the year ending at Michaelmas 1813 Chepstow exported more corn than any other west-coast ports except Carmarthen and Beaumaris.[12] The chief coastwise imports in the early nineteenth century were coal from Newport and the newly developed harbour at Lydney, general cargoes from Bristol and iron ore from Lancashire.

The first statement that the port was losing ground appeared in 1832, when a newspaper correspondent referred to "the drooping commerce of our little town," but complaints of this kind did not become numerous for another two decades. By 1856 the dock had fallen into disuse and five years later the yard for bonded timber was completely unoccupied. Thenceforth each decade brought its tale of slackness and inactivity. The number of timber and bark merchants with premises adjoining the river, five in 1848, decreased to three in 1852, two in 1865 and one in 1878. Attempts to revive the port in the late seventies failed to reverse the downward trend and in 1882 it was reported that trade had declined in the past year and that hardly any new vessels had visited the port. In the same year Chepstow ceased to be a separate Customs port, although the date of this change is not especially significant, for ten other ports were struck off the list at the same time. The last cargo of bark left the port in 1883 and the last ship from overseas was recorded in 1885.[13]

Fig. 4 is an attempt to show these changes in statistical form. Detailed manuscript shipping registers dating from 1786 survive for Chepstow, as for many other English ports, but regular annual returns of incoming and outgoing shipping for individual ports were published only from 1841, and after 1881 Chepstow's shipping was included in the total for Gloucester without being separately distinguished. At some ports these published returns may be supplemented by local Customs documents, harbour authorities' accounts, or shipping news in the local press; but except for the shipping registers the Chepstow

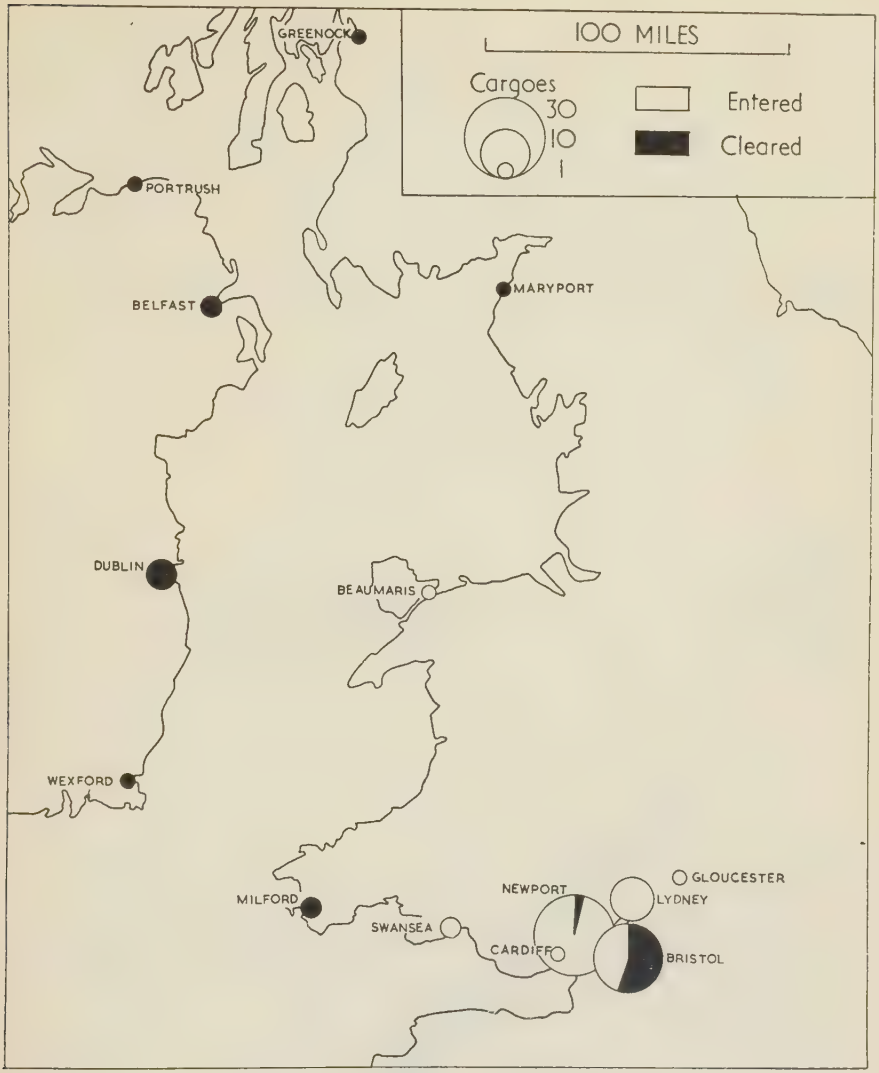

Fig. 3.—Chepstow's trade in four weeks of 1833 (*Monmouthshire Merlin*, 5th and 26th January, 2nd February, 11th May, 1833).

Customs records are not accessible, while the tonnage dues paid to the harbour authority (the Duke of Beaufort) did not distinguish between different commodities, and the local newspaper—the *Chepstow Weekly Advertiser*—seldom mentioned local trade and shipping. Such figures as are available suggest that the decline of trade was greatest at two periods—the 1830s, and the 1860s and onwards. Except in the fifties, foreign and colonial trade was almost negligible throughout the period 1841–81: the largest number of ships trading overseas in any one year was seventeen in 1853 and of the last twenty-five recorded years only two had any foreign exports. By 1871 the Irish trade

consisted of only five ships per year. Records of individual commodities are unfortunately very scarce, but it is significant that when a new group of low value goods was first included in the statistics of coastwise exports in 1873, Chepstow's *recorded* outward trade was almost trebled (Fig. 4), which suggests that such commodities, probably mainly stone, accounted for most of the exports. Coal seems to have comprised about half the total imports, although by the sixties more coal reached Chepstow by rail than by water[14] and imports of coal were halved between 1868 and 1881.[15] Like other small ports Chepstow retained its bulky, low-value trades longest.

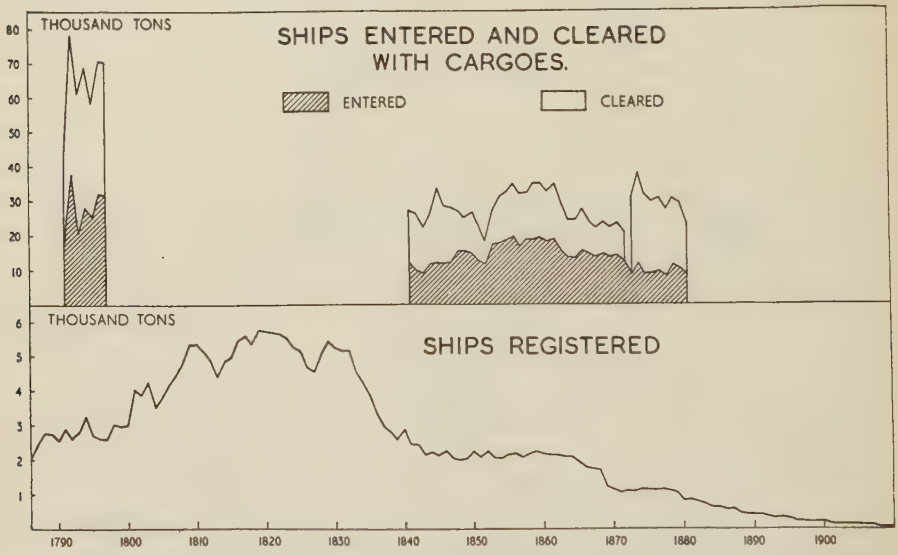

Fig. 4.—Chepstow shipping, 1786–1910. Lower graph from G. E. Farr, *Chepstow Ships*, Chepstow, 1954. Upper graph from Coxe, *op. cit.*, and *Parliamentary Papers, Annual Shipping Returns*, 1841–81. The apparent increase in exports after 1873 was due to the inclusion for the first time of coasters carrying ashes, bones for manure, chalk, clay, faggots, iron ore, kelp, lime, fresh meat, live fish, sand, slate, stone and timber for pitprops and sleepers.

It is now time to consider the factors contributing to the collapse described in the foregoing paragraphs. In the first place, the trade of Chepstow's neighbours to east and west increased prodigiously in the early nineteenth century: the Glamorgan and Monmouthshire Canals opened up the coal and iron resources of South Wales; the trade of Lydney, which served the Forest of Dean coalfield, was created by a canal made in 1813; and new life was brought to the port of Gloucester by the opening of the Gloucester and Berkeley Ship Canal in 1827. It is easy to see how a small port like Chepstow was affected by these changes. New traffic attracts return cargoes of goods formerly imported through other ports and diverts shipping previously employed elsewhere. Large-scale trade permits the installation of modern docking and handling facilities and the use of large vessels which would have

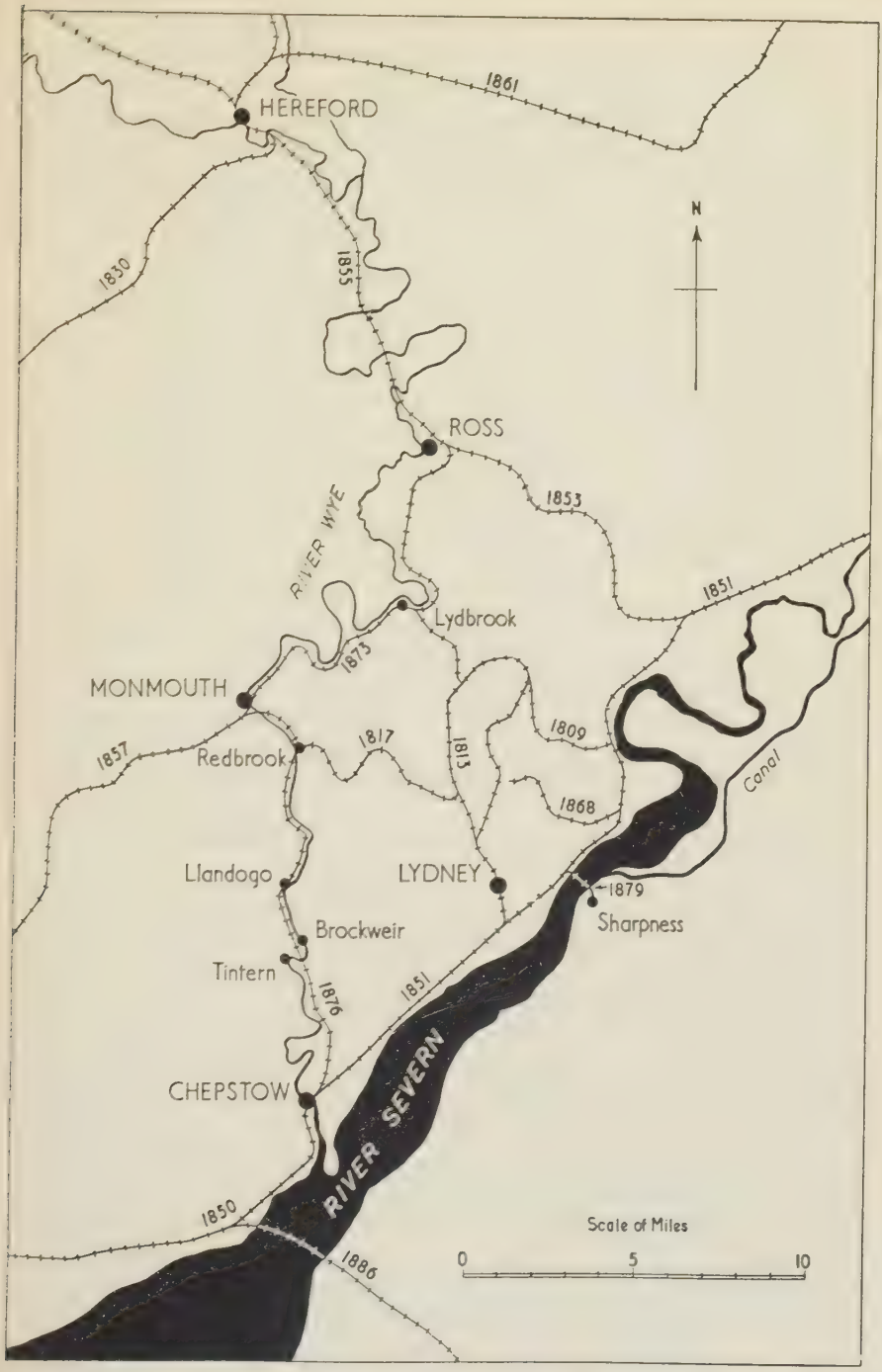

Fig. 5.—Railways and tramways in the hinterland of Chepstow. Dates from E. T. MacDermot, *History of the Great Western Railway*, vols. 1 and 2, 1927–31, and H. G. Lewin, *Early British Railways*, 1925. Certain mineral branch lines in the Forest of Dean have been omitted.

difficulty in disposing of their cargoes at small commercial centres. Such developments in their turn increase the competitive power of the major ports. These agglomerative tendencies become particularly effective if they are accompanied by such a reduction in land transport costs as resulted from the introduction of rail and motor transport; and their final outcome is a wider spacing of seaports along the coast, the smaller harbours gradually losing part or all of their traffic. The whole process is analogous to the decline of small inland marketing centres familiar to students of urban geography.

Chepstow suffered from these developments because it possessed no large and expanding trade to serve as a focus of concentration. Its river was not susceptible of further improvement, and in any case was scarcely worth improving, since its hinterland had become a region of economic stagnation and decline. Timber, the mainstay of the Wye Valley economy, was steadily being replaced by the coal and iron which brought prosperity to Chepstow's competitors. Shipbuilding had ceased by 1844, most of the ironworks established in the charcoal era had closed by the middle of the century, and the bark trade suffered from the introduction of exotic but more efficient tanning materials. Population trends afford a measure of this stagnation: of the thirty-nine towns and parishes which adjoin the river below Hereford, fourteen lost population in the half-century 1831–81 and the population of the whole group, including Hereford and Chepstow itself, increased only from 43,251 to 54,153; this was equivalent to no more than one decade's increase at Newport or Cardiff alone, apart from their hinterlands.

Railways, although they revived a few industries in the Wye Valley, did much to kill its waterborne traffic. The chronology of railway development in this region was especially unfortunate, for all the early lines drew traffic away from Chepstow and towards its competitors (Fig. 5). Completion of successive stages of the Hereford–Chepstow route merely diverted traffic from river to rail until by the time the railway network was complete there was no river traffic above Brockweir.[16] When the line finally reached Chepstow there was much talk of a commercial revival and a new wharf was built by the railway company, but the traffic of the Wye Valley railway was only about a seventh of what its promoters had anticipated and hardly any of it passed through the port. After working at a loss for no more than four years the wharf was leased to a local firm for shipbuilding purposes.[17] Even now Chepstow retained one advantage: the water route to Bristol was fifty miles shorter than the land route. Passengers crossing the Severn embarked at Portskewett, goods were shipped from Chepstow; and as late as 1879 a new company was formed to convey corn, flour and general merchandise to and from Bristol. Only a very small proportion of this traffic survived the completion of the last link in the railway network—the Severn Tunnel, opened in 1886.

In the most recent phase of Chepstow's history ships have been built, but not used. The output of iron ships, first launched in the 1880s, continued on a small scale until 1917 when Chepstow became the site of one of the National Shipyards, building vessels of up to 5,000 tons. Local excitement ran high, and a writer in the *Chepstow Weekly Argus* declared: "Chepstow is to be changed out of existence [and] by a fortunate turn of circumstances is destined to develop into a town equal in size and importance probably to any in South Wales . . . In years to come old residents will be able to seek the solitude of the ruins and look from the battlements on to miles of industrial activity—on to a city of ships." This destiny has not been fulfilled: no ships have been launched in peace-time since the early 1920s and the population of the town at the last census was a mere 5,285. No goods are now shipped or loaded at the town, although occasional barge-loads of stone are carried downstream from riverside quarries inaccessible by road and the Wye still serves as a nightly anchorage for the ferry boats which ply across the Severn between Beachley Point and Aust; otherwise the river is deserted.

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[1] The main stages in the improvement of the Wye are given in J. Lloyd, *Papers relating to the history and navigation of the Rivers Wye and Lug*, Hereford, 1873.

[2] P.R.O. *Exch. K.R. Port Books*. The following paragraphs are based on a selection from Bundles 1280–1295. The books purport to record the character, quantity and direction of every cargo, coastwise or foreign.

[3] For further details of the iron industry see B. L. C. Johnson, "The charcoal iron industry in the early eighteenth century", *Geogr. Jour.*, vol. cxvii, 1951, p. 167.

[4] Rhys Jenkins, "The copper works at Redbrook and at Bristol", *Trans. Bristol and Glos. Arch. Soc.*, vol. lxiii, 1942, p. 145.

[5] Bark exports from several ports are recorded in *House of Commons Journals*, vol. xviii, pp. 567–8.

[6] *Calendar of Treasury Books*, 1699–1700, p. 427.

[7] P.R.O. *Exch. K.R. Special Commissions* 7001.

[8] The foregoing paragraph is based mainly on Sir J. Bradney, *A history of Monmouthshire*, vol. iv, Part I, London, 1929.

[9] W. Coxe, *An historical tour through Monmouthshire*, London, 1801, Appendix 16.

[10] A full account of the trade from west-coast ports to Europe and to the east of England in 1811 and 1823 is given in *Parliamentary Papers*, 1824, vol. xviii, p. 320.

[11] No other English or Welsh port enjoyed such frequent communication with Bristol (*Universal British Directory*, 1792, vol. ii).

[12] *Report from Select Committee on Petitions relating to the Corn Laws*, 1814, Appendix 2, p. 122.

[13] The data in the foregoing paragraph were obtained from the collection of newspapers and directories in the Town Gate Museum, Chepstow. See I. Waters, *About Chepstow*, Chepstow, 1952, pp. 40–57.

[14] *Report from Commissioners on the Coal Supply*, *Parliamentary Papers*, 1871, vol. xviii, p. 959.

[15] Annual coal imports at all English ports are recorded in *Parliamentary Papers* (*Trade*) from 1868. The MS. Abstracts of Imports and Exports (P.R.O. *Customs* 23, 24) refer only to foreign trade and begin too late (1873 for imports and 1881 for exports) to be of much value for Chepstow.

[16] H. R. De Salis, *Bradshaw's canals and navigable rivers of England and Wales*, London, 1904, p. 451.

[17] *Herepath's Railway and Commercial Journal* and *The Railway Times*, volumes for 1877–1882.

The Port and Town of Freetown

H. R. JARRETT

THE PURPOSE OF THIS ARTICLE is to examine the position and site of the port and town of Freetown, capital of Sierra Leone. As a port we shall see that its natural endowments are particularly favourable, for the inhospitable character of the West African coast is now well known, with its heavy breakers and the surf which whitens its gently-shelving beaches, its muddy creeks often fringed with mangrove swamps, its sand spits and lagoons, its rapid silting and bar development, and, not least, its coastal lands of swamp and high forest. It has been observed that "in only two respects is the West African coast relatively fortunate—in its lack of coral reefs and lack of hurricanes"[1]—both, it will be noticed, negative virtues.

Fig. 1 focusses attention more sharply upon this formidable list of short-comings with special reference to the coastline of Sierra Leone. The muddy creeks, swamps, sand spits, and lagoons are all in evidence, while the high rate of siltation is well illustrated in the case of the port of Bonthe. In 1894 ocean steamers could reach York Island (B) at any state of the tide, while the steamer *Susu*, drawing 10 feet of water, regularly plied between Freetown and Bonthe where she berthed directly alongside the wharf. It was in 1939 that a sea-going vessel was able to reach York Island for the last time, while today ships have to anchor not far from the mouth of the estuary (point A).

Notice the considerable depth of coastal and inland swamp (the original high forest farther inland is now largely replaced by secondary bush), and the two peninsulas of fair size in the northern half of the territory. Each peninsula is attached to the mainland by a low isthmus, and both of these isthmuses, low as they are, give rise to distinct water divides along their spines which are therefore swamp free. The more northerly peninsula need detain us no longer for it terminates abruptly westwards in a line of cliffs about 80 feet high, while its northern part is swampy—obviously an unfavourable setting for a port and major town—but the southern isthmus, the spine of which I shall call the Koya divide, leads us from well inside the Protectorate on to the Colony Peninsula. Here, then, we have the only two swamp-free routeways leading from the interior to the coast, and it is the more southerly one which leads on to the useful Colony Peninsula (Fig. 2), which may be chiefly the remnant of a lopolith of which part has been cut away on the seaward side. The intrusive rock composing it has been called "noritic gabbro."[2] The intrusive remnant has been much

➤ Dr. Jarrett is Senior Lecturer in Geography at Fourah Bay College, Freetown. His article is based on a paper read to Section E of the British Association for the Advancement of Science in 1953.

Fig. 1.—Sierra Leone, communications.

denuded and is now scored by numerous gorge-like valleys, and it seems to have undergone marked isostatic uplift in consequence, for what may be the remains of former shorelines can be traced in series up the mountain sides. Encircling the main mountain mass is a narrow platform, probably the lowest of the raised beaches, standing at about 75 feet above sea level along its lower edge with its inner boundary masked by thick deposits of loose material washed down the steep slopes behind. This platform is happily swamp free for the most part, thanks to its cliffed seaward margin and also because the streams flowing across it have incised themselves deeply into gorge-like trenches.

Fig. 2 suggests how the main road and rail links connecting Freetown with the interior have been able in the main, by using the higher edge of this raised beach, to avoid on the one hand the steep mountain slopes and on the other the low-lying coastal swamps, while near Waterloo both road and rail pass naturally and easily on to the Koya divide. The only really difficult and dangerous section of the original road, apart from certain river crossings, was that which crossed the

Fig. 2.—Sierra Leone, the Colony Peninsula. The stippled areas indicate swamps.

Allen Town ridge between Wellington and Hastings, but that section is now avoided by a new road which sweeps around the eastern tip of the range alongside the railway.

With regard to this same Colony Peninsula we might further emphasize that there are no sites so well suited to urban and port development as the site upon which Freetown actually stands. The east coast is swamp-ridden; the south is without shelter and swampy in parts; while the west coast is isolated by the Colony mountains and exposed to the full force of the Atlantic breakers and the prevailing winds.

If we examine more closely the actual site of Freetown, (Fig. 3), we shall observe the cliffed coastline backed by the 75-foot raised beach

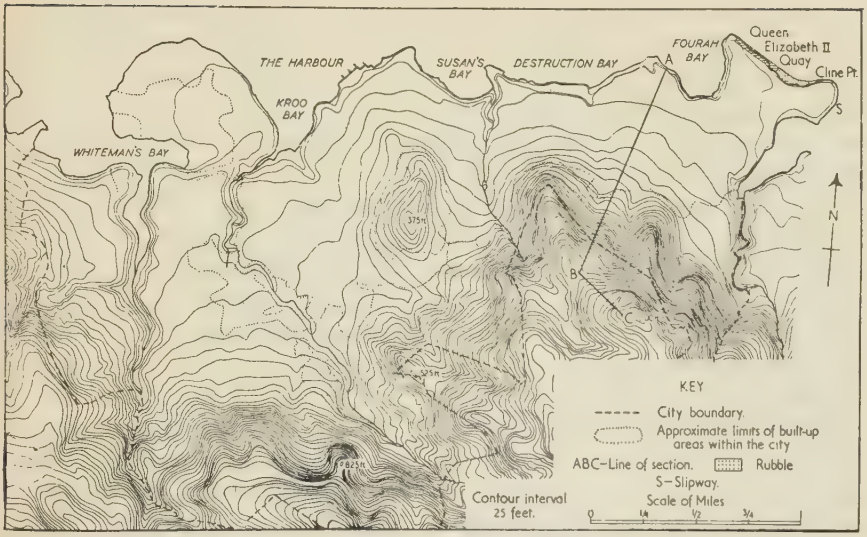

Fig. 3.—The site of Freetown.

which rises up gently to about 150 or 200 feet, from which level the Colony mountains begin to rise sharply.* This sequence is well illustrated by the section (Fig. 4) which also indicates some of the higher strand lines previously referred to. Both map and section bring out clearly the fortunate width of the raised beach. It is often merely a narrow shelf between the mountains and the sea, but here from the

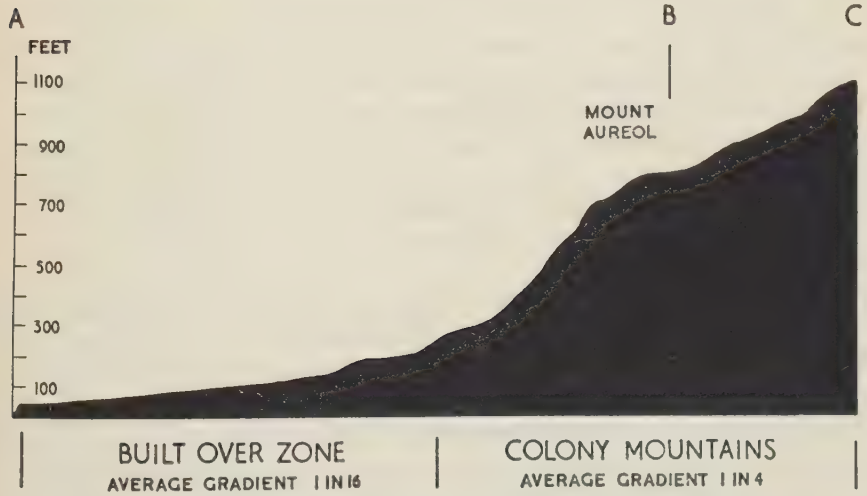

Fig. 4.—Section from Fourah Bay (A) to Kortright (C). Horizontal distance 1 mile 545 yds.

* In fact the 75-foot platform is itself a composite feature, for remnants of former strand lines appear to run along it. It is most difficult to plot them, however, owing to the built-over nature of the area.

Congo River (flowing into Whiteman's Bay) on the west to the Granville Brook along which part of the city boundary runs on the east, its width, though variable, is considerable. Even beyond this the feature continues in the Kissy Flats. Tower Hill remains, an almost isolated remnant of high ground to the south-east of the harbour, attached to the mountains by a low col. It is not at present possible to say exactly how much of the surface configuration is the result of subaerial and how much of marine erosion. It is true that the present rivers have by incision produced a number of north–south trenches which are still troublesome obstacles to communications within the town, but at the same time, as we have already observed, the value of these trenches and of the cliffs in discouraging swamp development is not to be overlooked.

It is upon this excellent site that Freetown has sprung up. The town has now extended over most of the 75-foot platform and has grown outwards from the part which was first laid out between the harbour and Tower Hill. The slope is more pronounced in this central section and it is likely that the drainage was originally better, for the flatter extremities of Brookfields and Cline Town, formerly segregated to some extent by the Alligator River and the Nicol Brook trenches respectively, are largely floored with an impervious lateritic crust which gives rise to an inferior type of vegetation known locally as "grassfields." Even today these grassfields are often under water during the rains as a result of the lack of slope and the impervious crust, though under heavy economic and population pressure, both of these areas are being more generally used.

Another feature which certainly affected the original choice of site was the availability of a good water supply. "King Jimmy's watering place," a small waterfall on Saunders Brook* no longer in existence, was a regular watering place for ships in the 18th century and a source of revenue to the local Temne "kings." The water is good, fresh from the mountain streams, and used never to fail even in the dry season, though this is no longer the case possibly because of deforestation and soil erosion. Active measures are now being taken to increase Freetown's water supply.

We should now consider the setting of the port of Freetown, and Fig. 6 shows the seaward end of the drowned Rokel estuary, commonly known as the Sierra Leone River. The shallows in the shelter of Tagrin Point require all ocean vessels to use the deep water channel off Freetown. While this channel may be the submerged course of a former river (possibly fashioned in part during the low water period of Pleistocene glacio-eustatism)[3] it seems likely that it owes its present-day existence to pronounced ebb scour. Fig. 1 suggests how the considerable amount of water gathered by the upper Sierra Leone River and moving

* The brook occupies the small re-entrant shown (Fig. 3) at the head of Kroo Bay. It now flows in a concrete channel.

seawards is swung southwards by the Bullom peninsula (terminating in Tagrin Point) towards the Freetown shore where it sweeps along the north coast of the Colony Peninsula. This course is indicated by the line of the deepest water on Fig. 6, the water to the north being slack, and it may well be that the deep channel owes its existence, at least in part, to an ebb flow which can attain a speed of 6 knots off Freetown. The largest ships afloat can anchor close in to the shore and a small amount of dredging would permit such vessels to berth alongside the new Queen Elizabeth II Quay. At the moment the draught of the deepest vessels using the harbour is 28 feet, while the minimum depth of water at the quay is 32 feet. The advantageous site of the new quay is further demonstrated by Fig. 5, which is a section drawn between the points A and B on Fig. 6. The considerable difference between high and low water marks is brought out, while two lines, A° and B° have been drawn to show the excellence of the site for shipping; A° represents the draught needed by the deepest vessels at present using the harbour, and B° that required by the *Queen Mary* (44′) (at low water in each case). The potentialities of the harbour are clearly brought out by this diagram.

The wind rose shows that the port is well placed to obtain maximum shelter. The prevailing winds from the west are scarcely felt there and while the formidable ocean breakers dash themselves on the Atlantic beaches the smallest launches and canoes find safe anchorage in Kroo Bay, Susan's Bay and Fourah Bay. Breakers from the N.W. are broken on the middle banks, while the fetch above Freetown is insufficient to permit the development of troublesome waves even during the squalls, which are of comparatively short duration. Indeed, when we sum up in our minds the entire physical advantages which this site enjoys for both town and port we cease to marvel, as the popular custom is, at the location of Freetown and wonder instead at the fine array of natural advantages assembled in this place which have enabled her far to outstrip her rivals.

Table I

CENSUS DATA FOR FREETOWN, 1931 AND 1948

	1931		1948	
African native	32,919	59·6%	46,081	71·3%
African non-native ..	21,754	39·2%	17,331	26·8%
European	285	1·2%	372	1·9%
Asiatic	400		792	
Total	55,358		64,576	

Although we are specially considering the spatial relationships of Freetown in this survey it would be out of order to say nothing at all about the people who live there. Up-to-date information is not available, but there are hopes that a census may be held in 1955. Table I summarizes what official information there is and perhaps the most striking single feature is that despite the over-all population increase between 1931 and 1948 the Creoles are declining

proportionately and absolutely. The Creoles are the descendants of the freed slaves who were brought in to found the Colony of Sierra Leone and the town of Freetown in the later 18th and early 19th centuries and in many ways they have been a privileged group. For instance most of the schools of Sierra Leone are in the small Colony in Creole country, so that these people have hitherto been able almost to monopolize the "black-coated" and professional posts. Today this monopoly is disappearing, and Africans are clearly being attracted into the capital from the Protectorate, a fact probably connected with the improved domestic communications of recent years (we might remember that not until 1940 was it possible to travel by road from Freetown to Bo, the chief town of the Protectorate). Unfortunately there is no breakdown of the 1948 figures according to tribal groups, though in 1931 the Temnes were the most numerous (11,405), followed by the Limba (4,960), Kroo (4,460), Mende (3,828), and Loko (1,623).[4]

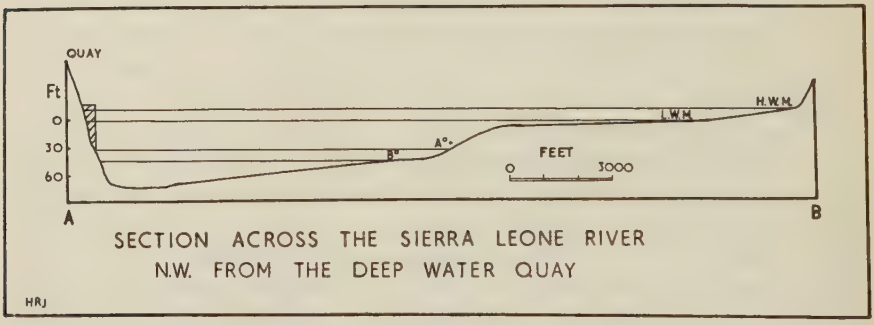

Fig. 5.

It might be interesting to note that a recent personal estimate made to the writer put the present population of Freetown at at least 80,000, while some of you may have noticed Professor Stamp's recent figure of 86,000,[5] the source of which is not given. And we may add that even in 1945 it was estimated that 100,000 people lived in the town and its suburbs.[6]

A map has been compiled (Fig. 7) which attempts to present the general pattern of land use in Freetown and, despite some complications, a recognizable pattern does emerge. The port and the modern commercial heart of the town stand on the site of the original permanent settlement and constitute the focus of city life. It will be interesting to see, say in 10 years time, how the Queen Elizabeth II Quay will have altered this pattern. The old coaling station on the east of Susan's Bay is now little used; palm kernels and chrome ore are railed to Cline Point east of the quay and shipped from there; while the near-by slipway is a new one for use in connection with tugs operating the new quay. The other slipway at King Tom north of Whiteman's Bay is owned by Messrs. Elder Dempster whose tugs and small craft ply in the harbour.

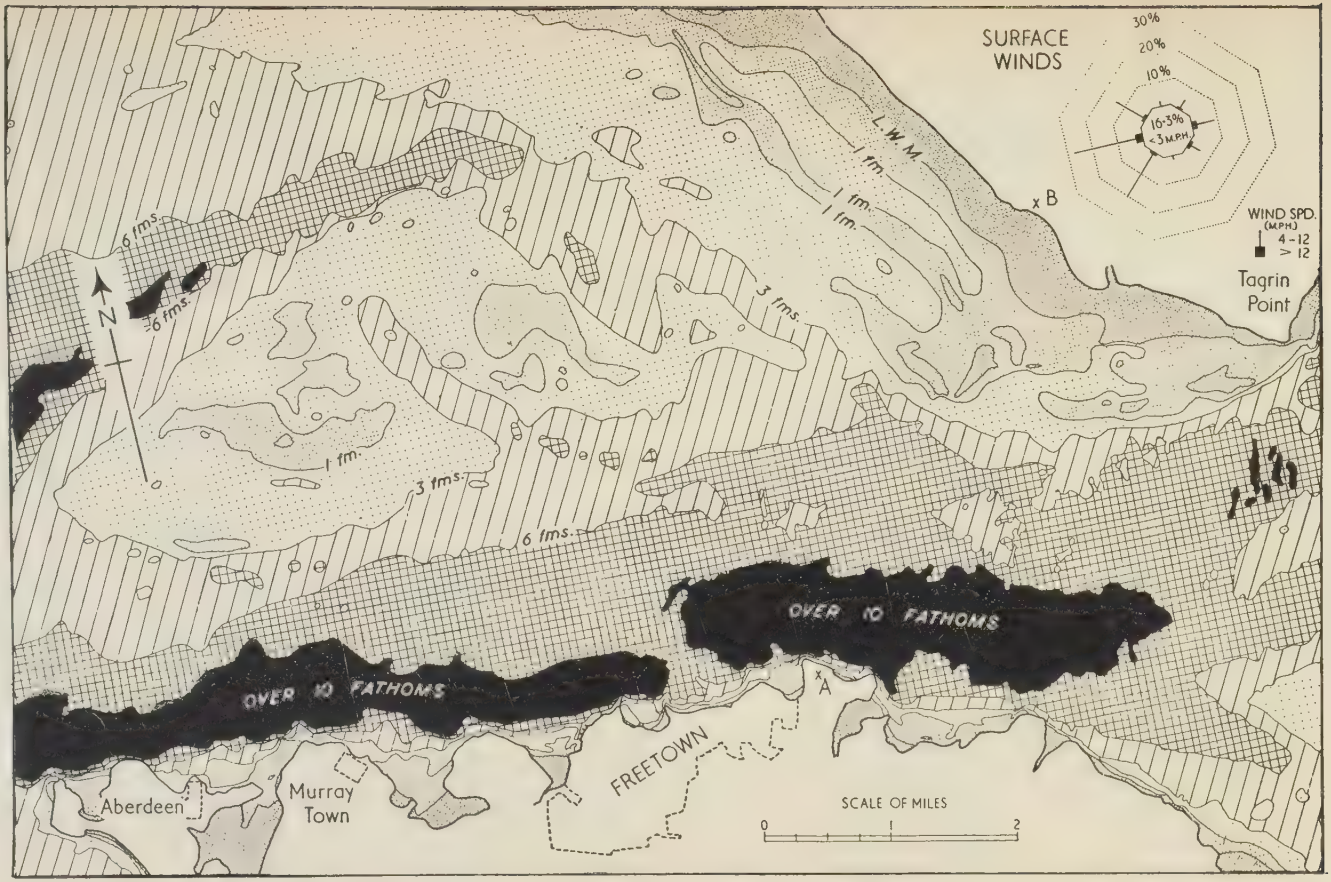

Fig. 6.—The Sierra Leone River. Bathymetric contours traced from Admiralty Chart, *Entrance to the Sierra Leone River*, 1946 edition. Wind rose compiled from information in *Statistics illustrating the climate of Sierra Leone*, Freetown, 1952, p. 54.

The central sector gives place inland to a residential one, and it is interesting to observe some traces of a "shatter zone" in the marginal slums. In fact a number of "slum spots," too small to be marked on this map, fringe the commercial zone. An estimate puts the density of population in the Susan's Bay slum at 487 persons per acre, an average of 23 people per house.[7] The chief interruptions to the residential zone include the ribbon-like retail trading strips along the more important roads and the Tower Hill military area together with Government House on the site of the old Fort Thornton.

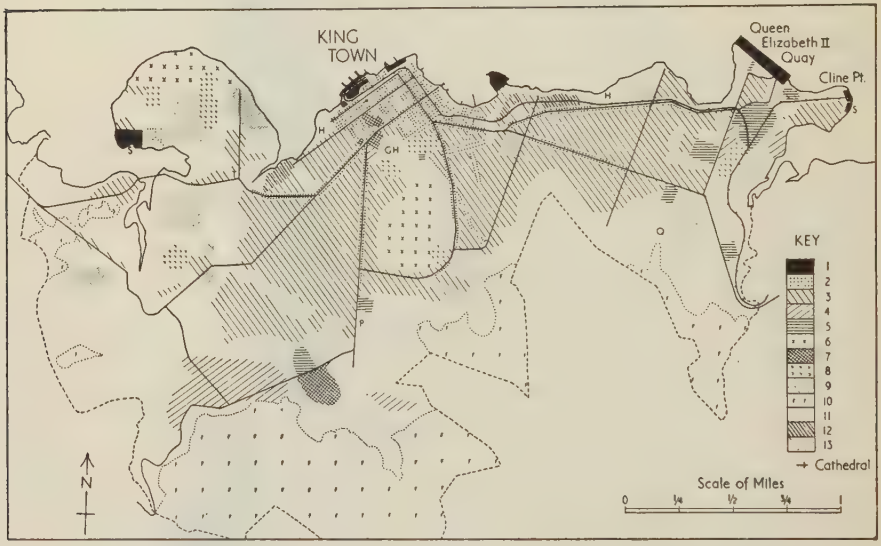

Fig. 7.—Freetown, general land use.
1, Port and ancillary; 2, Business and commercial; 3, Residential, general; 4, Residential, European; 5, Public services; 6, Military; 7, Administrative; 8, Recreational; 9, Educational; 10, Chiefly bush; 11, Chiefly unused; 12, Slums; 13, Cemetery; GH, Government House; H, Hospital; P, Prison; Q, Quarry; S, Slipway; T, Tyresoles.

In the central part of the town the residential zone marches right on to the lower slopes of the Colony Mountains, so that further development is "squeezed" eastwards to Cline Town or westwards to New England, Brookfields, or King Tom. We have seen why these areas have been little used until recently; there has been no planned development and their haphazard appearance contrasts strongly with the orderly layout of the centre. Administrative offices, schools, and what small industrial development there is, all tend to move into these outer areas impelled by the twin pressures of lack of space and rising rents in the town centre. It is envisaged that Cline Town should develop as the future industrial and commercial sector as the new quay comes into operation and that the old port will be replaced by a civic centre of generous proportions.

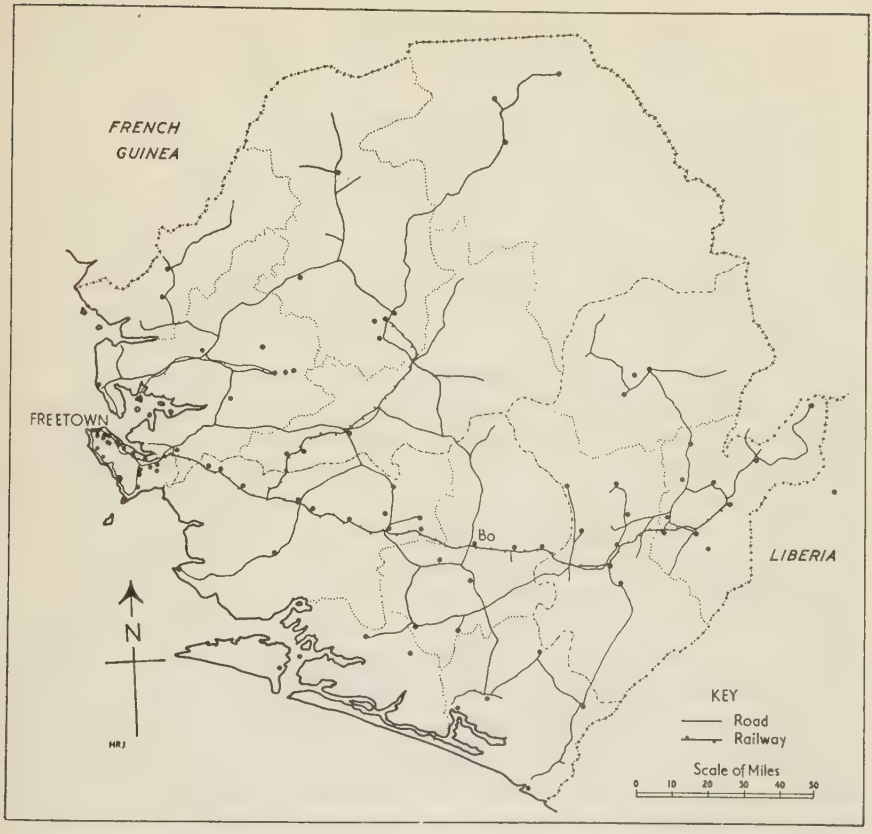

Fig. 8.—Sierra Leone, places with some form of direct service from Freetown.

Let us finally turn to a consideration of the links between Freetown and the territory which it serves, and let us acknowledge at once that of precise information there is practically none. The expedient was therefore adopted of taking three samples* which might reasonably be expected to show patterns of relationship in three contrasting spheres, and combining them, together with any further information which was gleaned: the result appears in Fig. 8. This method obviously has severe limitations but it is possible to argue that it is better than no method at all. We should view the map as a kind of synoptic chart which does provide an interesting commentary upon the general development of the country and which is certain to be greatly modified in the next several years as other towns such as Bo develop their own spheres of influence.

In more sophisticated communities we can conceive of the influence of a large town as "spreading" throughout the surrounding countryside, but this is apt not to be so in lesser developed areas, where urban

* Thanks to the kind co-operation of the Principal, C.M.S. Grammar School; the Manager, Kingsway Stores; and the Public Relations Officer, all of Freetown.

influence is often directed along road, rail or water tentacles from which it fastens upon the lives of people at certain spots only, much as the hold of an octopus is maintained at clearly defined points. In many instances, therefore, we must consider the dots on Fig. 8 as representing points of contact rather than as suggesting the spread of an urban field of influence, for it is doubtful if such a field exists much beyond the confines of the Colony. Many dots simply represent stations of Europeans or Americans who purchase, for example, their provisions from Freetown as local facilities do not exist; an outstanding example of this is provided by the spot marked in Liberia, which simply represents an Anglican Mission which finds it easier to purchase its provisions and other necessities from Freetown via Pendembu and Guekedou in French Territory than from Monrovia—a significant comment on Liberian communications. Despite these limitations, however, general experience in the country does suggest that the picture conveyed by this map is substantially true, and that, in so far as a field of influence exists, it is markedly rail- and road-guided, a further comment upon the importance of transport in Africa.

The importance of Freetown is undoubtedly growing, reflecting the expanding economic development of West Africa in general and of Sierra Leone in particular, though it is a great pity that a political strait-jacket exists in the shape of the circumscribed British territory which Freetown serves. Its strategic importance will undoubtedly increase—that will be ensured by its fine natural harbour in whose capacious waters large convoys were assembled without difficulty in World War II. It may be that today Freetown lies not so very far from the "striking fringe" of the Heartland, at a point well situated to be a gethering ground for the resources of the New World for their deployment in the Old. It is likely that we shall hear even more of this town in the future than we have in the past.

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[3] H. Baulig, *The Changing Sea Level*. Inst. Brit. Geographers Publication No. 3, London 1935, p. 4.

[4] *Report of Census for the Year* 1931. Freetown, undated, p. 56.

[5] L. D. Stamp, *Africa*, New York, 1953, p. 533.

[6] E. M. Fry and K. W. Farms, *Town Planning Scheme for Freetown*. Freetown, 1945, p. 3. The chief suburbs include Lumley, Aberdeen, Murray Town, and Kissy along the coast, together with Hill Station and the hill villages of Leicester and Gloucester.

[7] *Report of the Interim Town Planning Committee*. Freetown, 1948, p. 4.

This Changing World

EDITED BY L. S. SUGGATE

PROBLEMS OF LAND IMPROVEMENT AND RECLAMATION IN DENMARK

It is well known that an important addition to Denmark's cultivated land has been made since 1860. The area farmed has been increased by 20 per cent by cultivation of 1,750,000 acres of former heath land whereon 25,000 new farms have been established. A further 500,000 acres have been given over to conifer plantations or wind-breaks. Of the areas of heath land which yet remain uncultivated only 190,000 acres are potentially cultivable.

With the support of the Land Improvement Act of 1933 which granted a subsidy of one-third of the cost of all measures of field drainage, no less than 1,250,000 acres had been so improved up to the 1st January, 1953. The Land Reclamation Act of 1940 consolidated the 1933 Act, giving a subsidy of two-thirds to works of reclamation in river estuaries and on the low-lying shores of bays and fjords, where costly dykes and pumping-stations are needed. Such areas have some of the best soils in Denmark, but are rendered worthless by the high water-tables usually found there. From 1940 to 1953, 892 reclamation projects covering 276,000 acres were carried out under the 1940 Act. However, only one such project was concerned with the drainage of the sea floor—Lumby Strand near Odense—which was reclaimed in 1942–6. Of 2,500 acres drained in 1948, one half was colonized by nineteen homesteadings and six market gardens, the other half being handed over as additional fields to neighbouring smallholdings.

In spite of this appreciable work of expansion since 1933 the cultivated area has decreased considerably in the past twenty years, the average decrease being of the order of 20,000 acres yearly. (In 1934 the cultivated area was 8,130,200 acres; in 1953 it was 7,786,500 acres—a decrease of 343,700 acres.) This great loss of farm land is due to developments which cannot be stopped or maybe even contained—the growth of towns, road modernization, the building of sporting and military installations and so forth.

Apart from the small remaining area of heath, 120,000 acres of peat bog can be reclaimed. Yet circumstances are such that interest is now being taken in the reclamation of off-shore areas. Such possibilities are being explored by the Department for Research and Experiments of the Danish Heath Society. The technical possibilities, by dykes and drainage, are being supported by underwater soil surveys of the areas concerned in order to assess the suitability of the land so reclaimed for intensive agriculture. Ninety-three areas have been put forward as suitable for reclamation comprising 371,250 acres of which 297,250 are covered by water. The regional distribution of the schemes is shown:

	No. of Schemes	*Total Area* Acres	*Underwater Area* Acres
Jutland	21	155,000	117,500
Samsoe	13	4,250	3,250
Funen	17	67,500	60,000
Lolland-Falster	17	72,500	60,000
Sjælland-Moen	25	72,000	52,500
Total	93	371,250	297,250

For two reasons it is considered to be more profitable to undertake reclamation in the island areas of eastern Denmark rather than in Jutland. The first is that the off-shore areas are generally shallower in eastern Denmark, which implies cheaper dyke construction, fewer sluices and escape outlets and less pumping. The second reason is that the annual precipitation and run-off are appreciably less in eastern Denmark than in Jutland.

Since the passing of the New Land Reclamation Act of 30th April, 1953 which claims all new land won from the sea for the State, 40 of the 93 areas have been ear-marked for immediate detailed investigation. One of these areas, Venoe Bugt near Struer (8° 30′ E., 56° 30′ N.), may be cited as an example of reclamation in Jutland. This bay has a total area of 21,500 acres and the greater part of it is covered by water to a depth of 16 to 20 feet. The soil survey showed that 90 per cent of the area had clay or mud soils, the soil reaction being over pH7 in most cases. Only very few soil samples showed traces of sulphur and the salt content was in every case below two per cent. Such small contents of sulphur and salt can be washed out of the soil by natural drainage and the land reclaimed is therefore considered suitable for immediate cultivation. The greatest difficulty will be met in the construction of dykes, for 2·7 km. of the total 8 km. of dyke required must be constructed in depths of from 8 to 20 feet of water.

In contrast, the 4,735 acre Dybsoe fjord (11° 40′ E., 55° 10′ N.), on southwest Sjælland affords good conditions for dyking, depths being nowhere greater than seven feet. Yet an area of 1,900 acres is covered by a layer of sand to a depth of at least 20 inches, although the remainder is well suited to intensive farming, clay and mud predominating, in parts covered by a thin layer of sand. It is hoped to make a military training ground of most of the sandy area if reclamation is ever achieved, for there is considerable opposition to this particular scheme from the Ministry of Fisheries, since Dybsoe fjord is one of the best fish-breeding grounds on Sjælland.

The smallholdings on Lumby Strand have already shown good economic results, their gross factor income per acre being slightly higher than the national average. If the assumption is made that the income from future holdings on the areas to be reclaimed will be no more, yet no less than the national average for existing farms, the gross yield from the area which is to be added to Danish farmland will be of the order of £12 million annually. Even so, the total area of these reclamation schemes, 371,250 acres, is only slighter greater than the loss of farming land (343,700 acres) during the past twenty years. The work of the Danish Heath Society will still be concerned with the improvement of the existing farmed area during the years to come.

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ECONOMIC PROBLEMS OF FORMOSA

Recent developments in eastern Asia suggest that it is the policy of the United States to preserve the island of Formosa (together with the Pescadores) as a separate political entity distinct from mainland China. In these circumstances the ability (or otherwise) of Formosa to provide a livelihood for its present swollen and rapidly growing population is clearly a matter of far-reaching importance.

To the Japanese who controlled the island from 1895 to 1945, Formosa was valuable on account of both its strategic position in relation to China and southeast Asia and its capacity to produce surpluses, notably of rice, sugar and tropical fruit, for export to the metropolitan country on highly preferential terms. During the first four decades of the present century the Japanese systematically developed the food-producing capacity of Formosa by extending the acreage under cultivation, improving irrigation and greatly increasing the use of artificial fertilizer, more than 90 per cent of which was imported. By 1938 approximately 23 per cent of the island was cultivated, some 60 per cent of this being devoted to paddy, which gave an average yield of about 45 bushels per acre. The total production of rice, sweet potatoes, sugar and fruit in 1938 amounted respectively to 1,402,000, 1,726,000, 12,835,000 and 304,000 metric tons. At the same time, however, Japanese policy was opposed to the development of manufacturing industry in Formosa, and the local population was permitted to play only a subordinate rôle in the economic and political life of the island. Thus, although Japanese residents accounted for a mere 5 per cent of its total population, they formed the majority of the official, professional, managerial and technically skilled élite.

When, therefore, in 1945 Formosa reverted to Chinese rule the chaos resulting from the war was greatly aggravated by the repatriation of the Japanese community as laid down in the surrender terms. This, in turn, was followed by civil war on the mainland, culminating in the flight to Formosa in 1949 of some 500,000 members of the Nationalist armies as well as numerous other nationalist supporters, and in December of that year Taipei was proclaimed the (temporary) capital of (Nationalist) China.

Since the outbreak of the Korean war in June 1950 it has been a cardinal point in United States foreign policy to prevent this "unsinkable aircraft carrier off the China coast" from falling into Communist hands. Thus in recent years United States' aid, of the order of about $100 million annually, has been granted to the Taipei government which, largely in response to American recommendations, has introduced a far-reaching programme of reforms.

The most publicized of these has been land redistribution in accordance with the "land-to-the-tiller" doctrines of Sun Yat-sen. This has been taking place in three phases, the first involving the fixing of all rents at a maximum of 37·5 per cent of the principal crop, while the second (beginning in 1951) consisted of government sale of public land, mostly the former property of Japanese, to peasant cultivators on easy credit terms. Finally a further 35 per cent of the farming population has received equitable shares, on a similar basis, of some 500,000 acres which have been compulsorily purchased

by government from landowners holding more than the prescribed maximum (approximately 7·2 acres). It is now claimed that 85 per cent of the farmland is owned by the tillers.

No less significant is the Four Year Plan of 1953 for creating a viable economy in Formosa. Under this plan, aided by American disbursements in diminishing annual amounts, it is proposed to increase agricultural outputs and to develop enough local industry for the island to become economically self-supporting by 1957. Although 1954 figures are not yet available it is clear that significant increases are taking place in the production of certain key items. Thus in 1953 the outputs of the two main subsistence crops, rice (1,640,000 tons) and sweet potatoes (2,064,000 tons) were both in excess of the pre-war peaks. However, this increase was made possible mainly by reducing the acreage and consequent output of sugar cane (8,348,000 tons) and fruit (184,000 tons). In fact there seems to be very little prospect of any significant increase in the total cultivated area beyond the present figure of 2,178,000 acres. The eastern three-quarters of the island are extremely rugged country, rising to over 13,000 feet, and it is only in the western littoral which is now being utilized virtually to capacity that cultivation is economically practicable. In theory, at least, some increase in yields per acre is possible, though the present figures are well above the average for Monsoon Asia and the consumption of chemical fertilizer (661,156 tons in 1953) is relatively high.

For this reason the expansion of fertilizer production occupies first place in the programme of industrialization and already in 1953 approximately one quarter of the total used was manufactured in the island. Next in importance come textiles, and it is claimed that Formosa now manufactures nearly enough cotton cloth for its own needs though the raw material still has to be imported. The remaining industries which are now being built up include cement, paper, pulp, petroleum-refining and ship-repairing. Power for this expanding industry is largely electric. In mid-1953 there were 24 thermal- and 8 hydro-electric generating plants with a total installed capacity of 330,645 kW. and it is proposed to increase this by another 300,750 kW. by 1957. Already in 1952 the output of electric power (1,420,313,000 kWh.) exceeded the pre-war peak by 20 per cent.

Despite these evident signs of progress and the freeing of the island from its former economic obligations towards Japan, its prospects are nevertheless far from encouraging. At the present time some two-fifths of Formosa's imports are being paid for by M.S.A. (Mutual Security Agency) aid and it is difficult to see how the island can replace this by exports of its own. (In 1952 exports of sugar, 458,182 tons, and of rice, 107,415 tons, compared very unfavourably with the 1937 figures of 1,111,000 and 688,027 tons respectively.)

Most serious of all, however, is the rapid increase in population. Compared with the 1932 figure of 4,932,433, the official estimate for 1953, *civilians only*, was 8,260,961 and one unofficial but by no means improbable estimate puts the present total at over 10 million. For, largely as a result of improvements in hygiene and sanitation carried out under United States guidance, the crude death rate had fallen to approximately 10 per 1,000 in 1951 while the crude birth rate remained at the very high level of 44 per 1,000. In 1953 the rate of increase was stated to be 36·38 per 1,000 which is probably

the highest in the world and, if sustained would lead to a doubling of the present population within the next 21 years. Yet already the average density of population in this almost exclusively agricultural island is 724 per square mile and, for the cultivated area, over 3,000 per square mile. Unless, therefore, the present phenomenal rate of increase can be drastically reduced in the very near future it would seem that all other projects so far envisaged will be at best temporary palliatives and, of themselves, utterly insufficient to avert catastrophe.

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SOME EFFECTS OF THE OWEN FALLS SCHEME, UGANDA

The Owen Falls hydro-electric scheme at Jinja in the Eastern Province of Uganda was inaugurated by H.M. the Queen on 29th April, 1954. Hitherto economic advance in the Protectorate has rested mainly upon agricultural production for the world market, especially upon cotton and coffee. The hydro-electric scheme will open up larger possibilities of industrial production in a country which has so far proved notably deficient in other sources of power. This new development coincides with an increased interest in the mineral resources of Uganda.

The decision by the Uganda government to implement the Owen Falls project dates only from 1947 and the main civil engineering contract was placed in 1949. The dam stands a mile and a half below the outflow of the Victoria Nile from Lake Victoria by the Ripon Falls. These falls, discovered by Speke in 1862, will shortly be submerged beneath the rising waters. In its early stretches the youthful river lies between steep banks which rise about 120 feet above it (see Plate I). The bedrock of the river is composed of quartzites and shales, interspersed with bars of amphibolite striking SW–NE across the course of the Nile. It is one of these bars which gave rise to the Owen Falls and now provides a solid base for the masonry of the dam (see Plate II). The completed dam has a maximum height of 85 feet and a length of 2,725 feet, and the reservoir it contains may virtually be considered as being the 26,000 square-mile extent of Lake Victoria itself. It has been calculated that the lake level will eventually rise some four and a half feet above the present recorded maximum, but this process will take almost twenty years. The ultimate installed capacity of the power scheme is rated at 150,000 kW. which will be provided by ten turbines, each of 15,000 kW. capacity. Two such units are now operating and four more are under active construction. It has recently been announced that the Uganda Government is shortly to seek a loan of £6,000,000 to furnish the four remaining turbines at a much earlier date than had been originally planned. The increase in the power potential of Uganda that the new dam represents may be judged from the fact that the maximum demand on the whole Protectorate grid for the year 1953 was 13,000 kW., a load which can now be borne by one of the Owen Falls turbines. The application of the new power thus depends upon a general economic expansion.

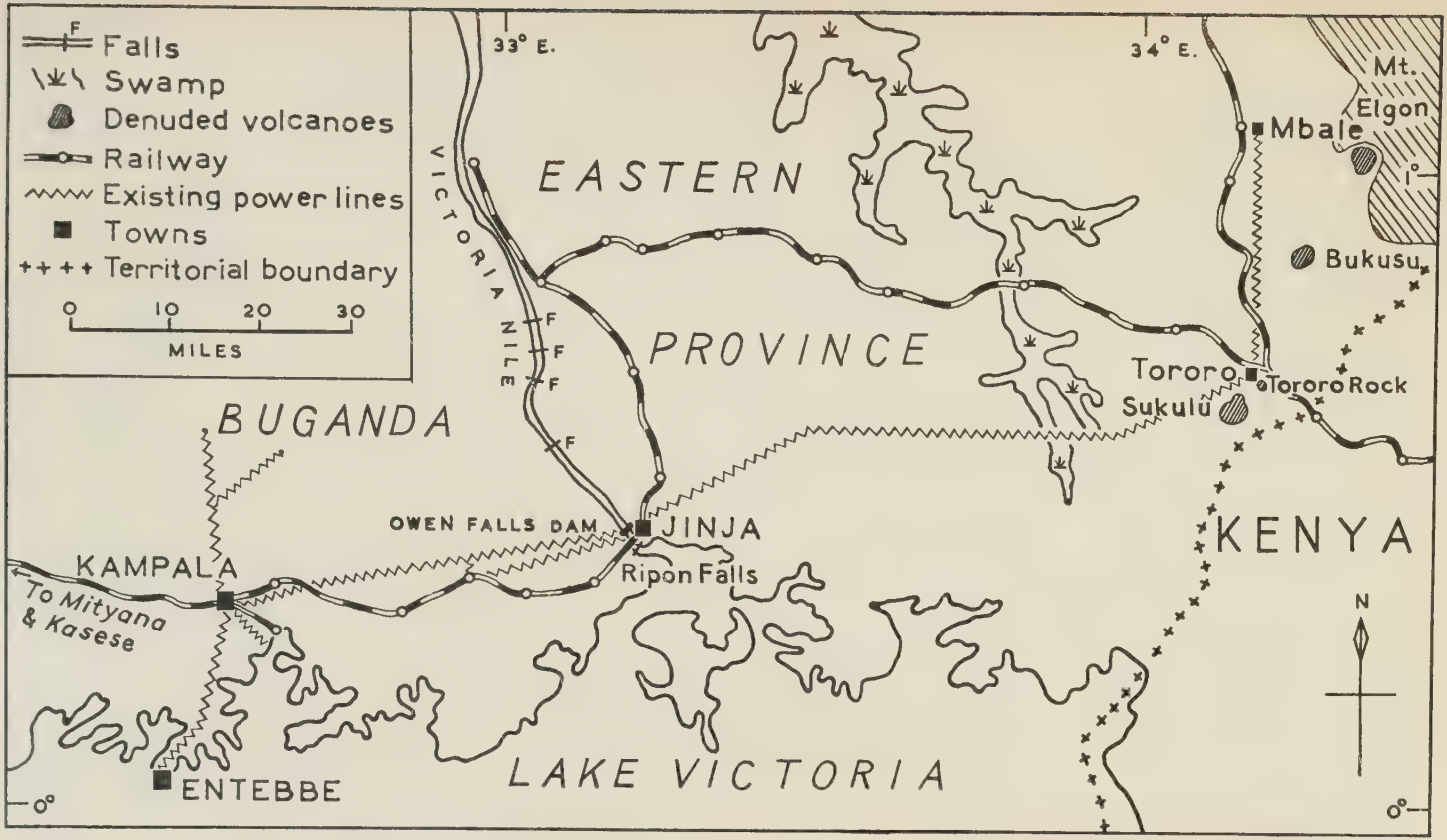
The town of Jinja, standing at the lakeside on the east bank of the Victoria Nile, seems destined to become a considerable industrial centre. At present a tobacco factory, an oil mill and cotton ginneries provide its main industrial activities and a grain storage plant with a capacity of 12,000 tons of maize,

considered a prerequisite of large scale urbanization, is in operation. An important textile mill and a brewery are under construction. Present plans also envisage the erection of a large smelting plant for the conversion into electrolytic copper of concentrated ore from the Kilembe Mines of the Ruwenzori flanks in western Uganda. The completion of the new 205-mile railway running westwards from Kampala to Kasese will be a vital link in this plan. Such a smelting industry would be a major consumer of power and would open up possibilities of allied chemical industries at Jinja. Current developments have already had their impact upon the growth of the town; the urban population, which stood at 3,120 in 1930, had risen to 8,400 in the census of 1948 and was estimated at 20,800 in 1951. The town plan contemplates an ultimate population of 80,000. Industrial expansion is to be accommodated mainly on the west bank of the Nile, lying in the province of Buganda.

Owen Falls power may find another major market through mineral development in the area around Tororo in eastern Uganda. Southwest of Mount Elgon lies a line of four denuded volcanoes of Cretaceous age and the geology of three of these, namely Bukusu, Sekulu and Tororo Rock, has been studied in some detail. They exhibit cores of carbonatite, which may be regarded as a limestone of magmatic origin, and have surrounding ring complexes of diverse and valuable minerals, available in appreciable quantities. Amongst these minerals, magnetite, vermiculite, zirconium, apatite and pyrochlore are the most significant. Apatite is a rich source of phosphate, and pyrochlore is a source of the strategic mineral niobium, used in jet-engine manufacture. The total quantities of these minerals is impressive but their ready exploitation is hampered by the extensive apron of laterite which masks some of the deposits and by technical problems arising from the varying concentration and chemical composition of the deposits, which have in the main been weathered from and redistributed around the former volcanic cores. These problems are being investigated by a company jointly financed by official and private commercial interests and the exploitation of some at least of these minerals, under the stimulus provided by the availability of the new power resources, may safely be predicted. Indeed a start has already been made in the cement factory at Tororo, which began active production in 1953. It draws upon the carbonatite of Tororo Rock, is served by a power line from Jinja and supplied more than a third of the cement used in the construction of the Owen Falls dam. With this major customer now satisfied, it can currently undersell imported cements in the Uganda market.

The proposal to instal the final four turbines at the Owen Falls is closely related to the schemes, now under active consideration, for exporting electric power to Kenya, to supply the towns of the western part of the Colony and to serve Nairobi itself.

It is thus distinctly possible that the total output of the Owen Falls scheme may be absorbed by expansions in mining and manufacturing and by the resulting urbanization. Then the tentative plans for further hydro-electric installations along the Victoria Nile would be brought into focus. Much will clearly depend upon political imponderables and it is possible that in the next few years, while the developments outlined above get underway, the demand for power may lag behind the potential production.


F Falls
Swamp
Denuded volcanoes
Railway
Existing power lines
Towns
Territorial boundary
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33° E.
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EASTERN
PROVINCE
VICTORIA NILE
Mt. Elgon
Mbale
Bukusu
Tororo
Tororo Rock
Sukulu
BUGANDA
OWEN FALLS DAM
JINJA
Ripon Falls
KENYA
KAMPALA
To Mityana & Kasese
ENTEBBE
LAKE VICTORIA
N
A. SERUBIRI 1954

It is at present planned to build a dam at Mutir on the Albert Nile, thirty-five miles north of the outflow of Lake Albert, the primary purpose of which will be water conservation and regularization. Mention of it introduces a fresh aspect of the Owen Falls dam; the important part that it is destined to play in the regularization of the waters of the White Nile for the benefit of Sudan and Egypt. To this end, at the request and the expense of the Egyptian Government, the Owen Falls dam has been built one metre higher than was necessary for the power-scheme itself. (Sir J. H. Hall, "Some aspects of economic development in Uganda," *African Affairs*, vol. 51, No. 203, April, 1952, pp. 124–134. H. Olivier, "Some aspects of the Owen Falls scheme," *Uganda Journal*, vol. 17, No. 1, March, 1953, pp. 28–37.)

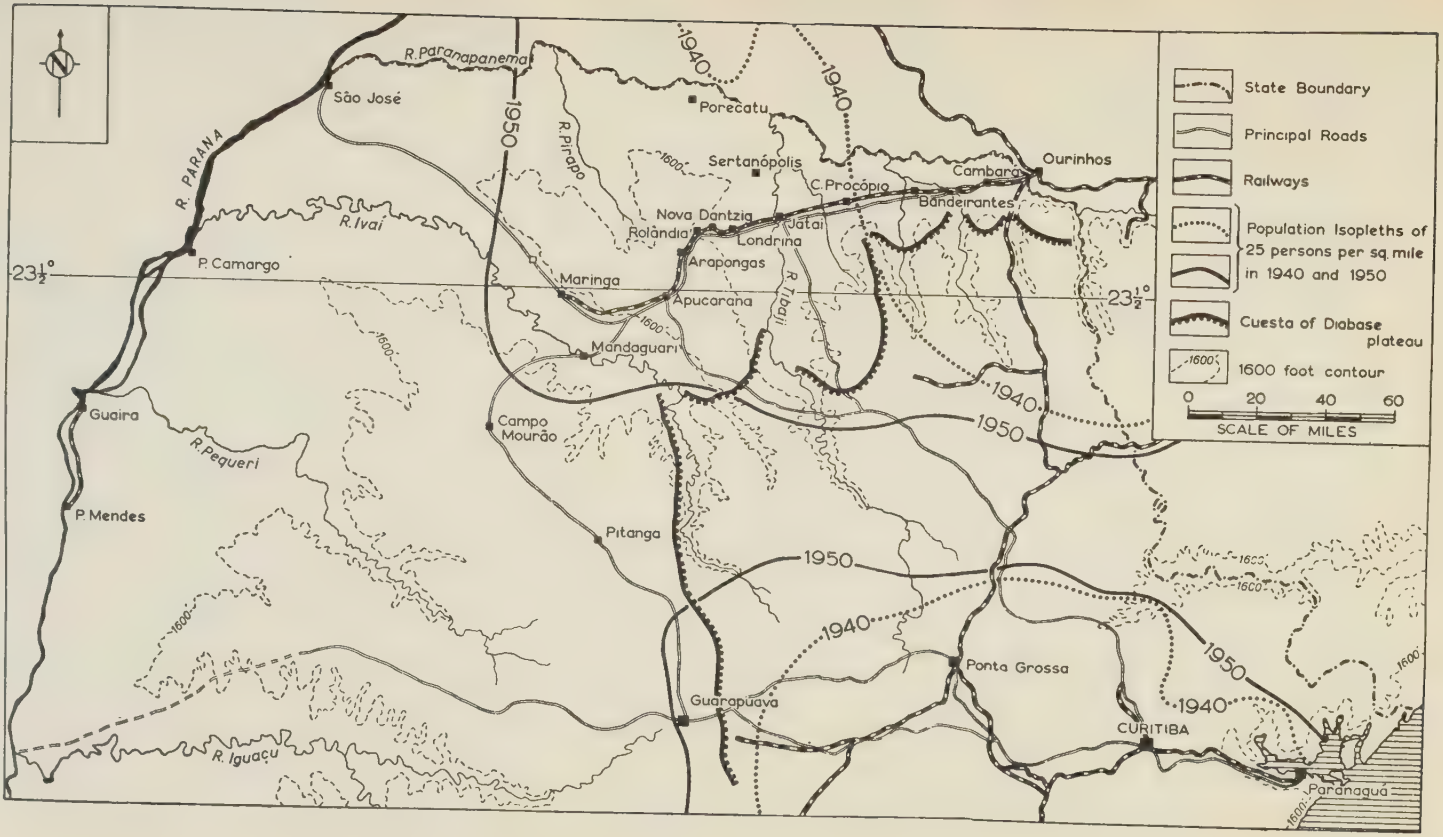
Makerere College, Kampala, Uganda. DAVID N. MCMASTER.

THE COLONIZATION OF NORTHERN PARANA

In the last quarter-century few areas in the world have been the scene of such extensive colonization as has occurred in north-western Paraná. A frontier movement, reminiscent of the United States during the nineteenth century, has transformed an almost uninhabited wilderness into a thriving zone with a well-balanced economy of subsistence and commercial agriculture and many new urban settlements serving as collecting and distributing centres.

Although administratively within the state of Paraná, the area has been peopled *via* São Paulo across the Paranapanema river which here forms the boundary between the two states, and in this aspect of its historical geography it is more associated with São Paulo than with southern Paraná, which is also experiencing another but rather different frontier movement based on Curitiba and Ponta Grossa. The colonization of northern Paraná, however, shows some important economic contrasts with São Paulo, and does not share the speculative boom characteristics of that state, and the land abandonment and depopulation associated with its frontier zone. Indeed, a fundamental feature has been the careful planning and organization of settlement and land use. This has been largely due to the efforts of the *Companhia de Terras Norte do Paraná*, formed with British capital in 1929, which bought from Paraná State over 3 million acres of land extending from the Paranapanema river southward to the Ivaí-Pequeri interfluve. Following a careful survey, roads, railways, forest and soil conservation measures, size and distribution of holdings were all planned in advance to ensure a sound and permanent economic utilization of the region. Although sales of land by the Company were slow at first, the post-war period has seen a great rush of colonists, so that less than 350,000 acres now remain of the original holding.

The farms vary in size from 30 to 600 acres, the average size being about 100 acres with some 50,000 coffee trees. Although on most farms coffee is the principal crop, considerable quantities of maize, beans, rice and vegetables are grown, the maize crop for 1953 exceeding 1 million bags. The rolling country of the interfluves between the tributaries of the Paraná and those of the Paranapanema is what the *Paranaenses* call the "*Terceiro planalto*" or "third tableland," northwest of the diabase cuesta. Its physical advantages of *terra roxa* soil and mainly frost-free climate are the basis of


R. Paranapanema
São José
R. PARANA
R. Ivaí
P. Camargo
23½°
Guaira
R. Pequeri
P. Mendes
R. Iguaçu
R. Pirapó
1950
1940
Porecatu
Sertanópolis
C. Procópio
Cambará
Ourinhos
Bandeirantes
Nova Dantzig
Rolândia
Jataí
Londrina
Arapongas
Maringá
Apucarana
R. Tibagi
Mandaguarí
Campo Mourão
Pitanga
Guarapuava
Ponta Grossa
CURITIBA
Paranaguá
1600
State Boundary
Principal Roads
Railways
Population Isopleths of 25 persons per sq. mile in 1940 and 1950
Cuesta of Diabase plateau
1600 foot contour
0 20 40 60
SCALE OF MILES

its agricultural wealth, and high coffee prices have proved an additional stimulus to its rapid utilization.

Many of the urban centres which have been established are notable examples of modern town planning. Conspicuous in this respect is the capital of northern Paraná, Londrina, named after London. Although less than 25 years old it has a population approaching 50,000, which is five times the number it had in 1940. Maringa, the second largest town, did not exist in 1946, and Rolândia, Apucarana, Arapongas, Mandaguarí and many others have come into being only in the last two decades. Road and rail communications are pushing westward linking these newly colonized areas to Santos and Paraguaná, which each receive about equal proportions of Paraná's coffee production, the value of coffee exported from Londrina in 1952 exceeding £12 million. Already the road from Apucarana into São Paulo *via* Ourinhos is the third busiest in Brazil, and the State Highway Department, realizing the economic importance of keeping transport facilities abreast of the colonizing developments, has embarked on a ten-year plan to provide 6,000 miles of paved roads in Paraná.

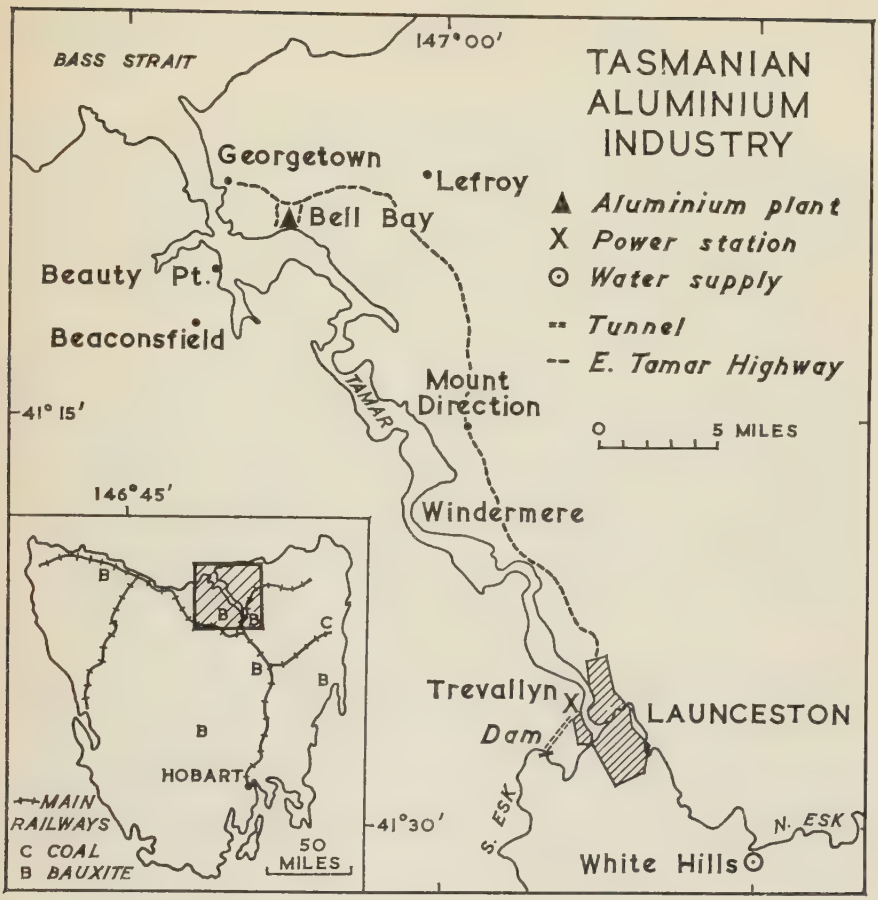
The pace of this frontier movement shows little sign of slackening, and it is conservatively estimated that some 250,000 people have moved into the state since 1950. The census in that year had already shown that in this century no other Brazilian state (not excluding São Paulo with its phenomenal expansion) has grown so rapidly as Paraná. Throughout the 1940–50 decade the population increase exceeded seven per cent annually. The following population figures speak for themselves:

1900	1920	1940	1950
327,000	686,000	1,236,000	2,150,000

University of Birmingham. GILBERT J. BUTLAND

AN ALUMINIUM INDUSTRY IN TASMANIA

Aluminium alloys, second only to steel among the materials essential to modern industry, are assuming increasing importance in the world's economy. Foremost among recent industrial developments in Tasmania therefore has been the establishment of the Australian Aluminium Production Commission's plant at Bell Bay, near the mouth of the Tamar River. This plant, which cost nearly £A10·5 million, combines all stages of production from bauxite to aluminium in one integrated unit: as such it is unique in the southern hemisphere and one of the few of its kind in the British Commonwealth. Production was originally scheduled to begin in 1953, but owing to delays in the construction not only of the aluminium works but also of the Trevallyn power scheme on which it depends, the manufacture of alumina began only in February, 1955, and its reduction to aluminium is not due to start until July. Initial output will be at a rate of 10,000 tons of ingots a year, but by the end of 1955 the rate will have increased to 13,000 tons and perhaps by 1960 to 20,000 tons. Even the present capacity of 13,000 tons is slightly higher than the current Australian consumption, so that, providing costs can compete with Canada's, Australia bids fair to become a significant exporter, particularly to the sterling area. In recent years Australian



imports of aluminium have entailed the annual expenditure of 6 million dollars.

Power costs, the major factor in aluminium production, will certainly rank among the lowest in the world, even lower than those of the large-scale Kitimat project on the Canadian west coast and only a quarter of those in the aluminium industry of Scotland. The Trevallyn scheme, the first undertaken by the Hydro-Electric Commission outside the Central Plateau, involved the construction of a 75-foot high concrete dam across the second basin of the South Esk River, thereby creating a lake 3 miles long. To conduct the water to the power station on the west bank of the Tamar, a $2\frac{1}{4}$-mile tunnel has been driven through the intervening ridge by the Compagnie Industrielle de Travaux, a subsidiary of the famous Schneider group; an intake structure regulates the flow. At its lower end the tunnel is closed by a concrete plug, from which penstocks, 500 feet long, carry the water to four 28,000 h.p. turbines, operating under a gross head of 415 feet. The water is finally discharged into the Tamar. Most of the electrical plant was made by the English Electric Company, but some came from Sweden; the port of entry was Beauty Point. The production of alumina takes only

3,000 h.p., but the operation of the aluminium plant will require an additional 32,000 h.p. and maximum output a total of 43,000 h.p. The balance of 69,000 h.p. will be made available to the Launceston area, particularly to the new industries of the Tamar valley.

Although the Bell Bay works are well located not only in respect of power resources but also of raw materials and water supply, Windermere might have proved a better site. Both Bell Bay and Windermere have a deepwater ($5\frac{1}{2}$ fathoms) approach, essential both for the importation of bauxite (at first from Malaya and later perhaps from the Northern Territory or Queensland) and for the shipment of aluminium to the mainland or export markets. But if Tasmanian bauxite is used (it constitutes a strategic reserve), Windermere is nearer the railhead at Launceston, and in any event the coal used in the manufacture of alumina must be brought by rail from the Cornwall Colliery at Fingal. So far, the Commonwealth and State Governments have failed to agree on the financing of the proposed railway from Launceston to Bell Bay, a distance twice as great as that from Launceston to Windermere, but at least the East Tamar Highway is to be shortened by a direct link from Mount Direction to Bell Bay. As for water supply, a pumping station with a capacity of 3·5 million gallons a day has been built at White Hills on the North Esk, but eventually a gravity intake of almost twice this capacity may be constructed at Watery Plains, 8 miles upstream and 1,000 feet above sea level. In either case, Windermere is nearer the source of supply.

Future industrial development in the Tamar valley, if granted free choice of location, would almost certainly gravitate to the Windermere–Launceston area, but the regional planning scheme now being formulated, together with the new wharf at Bell Bay, may limit industrialization, at least of the eastern shore, to the Georgetown district. Already Georgetown, the oldest settlement in Northern Tasmania (1811), has changed almost overnight. Twice before in its history the town has been on the brink of prosperity: in the seventies, when gold was discovered near Lefroy; and in 1927, when a port was established at Bell Bay; the gold soon petered out, and the port failed to attract shipping, probably through lack of a railway. In 1949 Georgetown had a population of only 350, mostly fishermen, pensioners, and a few small farmers. Today, it is virtually the housing estate of the Aluminium Commission with a population approaching 2,000. Works construction alone gave employment to 700 men, a quarter of whom were "new Australians" (Italians, French, Poles, Lithuanians, and Spaniards); the operation of the plant will provide permanent employment for 600. With further industrialization Georgetown may well become the second largest town in Northern Tasmania. Meanwhile, the commencement of aluminium production at Bell Bay will mark an important stage in the industrial development of Australia.

University of Tasmania, Hobart. PETER SCOTT.

The Geographical Association

GIFTS TO THE LIBRARY

We record our warm thanks to Miss Rickards (Honorary Secretary 1910–17) who has given the Library a valuable and interesting geographical volume, *Introductionis in Universam Geographiam*, by Philippi Cluverii, dated 1627.

We are grateful to the North Derbyshire Field Club for the gift of a part-set of the *Quarterly Journal of the Geological Society*, vols. xliv to lxv, 1893–1909, which extends our existing collection of that periodical.

PUBLICATION OF THE LIBRARY CATALOGUE

It has been decided that the long-awaited library catalogue shall be published in some 10 to 12 sections, each costing about 2s. The printing of the first of these sections (dealing with books on Asia) will be undertaken this summer, and we hope that, through the good offices of our Honorary Librarian, the publication of the ensuing sections will follow at reasonably short intervals. Supplementary leaflets will be published from time to time to keep the catalogue up to date, and an overall cover for the catalogue and supplements will be designed. It would greatly help headquarters if members or institutions wishing to purchase the sections would inform the office at once, so that an edition adequate in size to meet members' needs may be printed.

REQUEST FOR SCHOOL CHILDREN'S ESSAYS

A request has been received from the editorial staff of the publication *Children of the World* (address: Heibon-sya, Yonban-tyo, Tiyoda-ku, Tokio, Japan) for short essays written by British school children, ages 7–11 years, illustrating how they live and work, day by day. Contributions should be sent in English. An exchange of material is offered to collaborators. The publications are to be directed towards Primary School and Modern or middle School levels in Japan.

BRANCH NEWS

We record with pleasure the formation of the West Middlesex Branch, whose secretary is Mr. H. J. Savory, Borough Road College, Isleworth, Middlesex.

It has been proposed to form a branch at Watford, and interested members should get into touch with Mr. J. B. Rigg, Brendon, Wyatt's Road, Chorley Wood, Herts. Efforts are being made to re-form the Newcastle-upon-Tyne Branch, and enquiries about activities and local membership should be addressed to Mr. J. W. House, Department of Geography, King's College, University of Durham, 1–2 Singleton Terrace, Newcastle-upon-Tyne.

A group of members in Mauritius has asked for affiliation as a local society.

We regret to announce the temporary suspension of the activities of the Cornish Branch.

SPRING CONFERENCES, 1956 AND 1957

The Spring Conference in 1956 will be held at Brighton at the kind invitation of the Council of the Borough and of the local Branch.

The Conference in 1957 will be held at Nottingham by kind invitation of the University of Nottingham and of the local Branch.

SUMMER SCHOOLS

So great has been the demand for places at the Summer School to be held in August at Aix-en-Provence that reservations had all been filled and there was a

long waiting list shortly after the course was advertised. In view of this, the officers will endeavour to organize a second course in this region next year, in addition to another Summer School elsewhere.

SPECIAL PUBLICATIONS

The attention of members is drawn to the following new or recent publications which can be obtained from headquarters office:

Lincolnshire Studies, reprinted from *Geography*, vol. xxxix, part 2, 1954, 2s.

Geography in the Secondary School, with special reference to the Modern School; 2nd edition, including a new appendix on a school syllabus, 2s.

Geography in the Primary School, 2nd edition (with minor revisions), 2s.

COVERS FOR *Geography*

Orders can be accepted for the loose binding covers for *Geography* first advertised in the journal in April 1954. These are available in a choice of colours, with one pocket, to hold 4 parts (1 volume), or two pockets to hold 8 parts (2 volumes), priced about 10s. and 15s. respectively. Order forms should be requested from the Assistant Secretary at headquarters.

Arrangements can also be made to supply, on order, binding covers for private, formal binding of *Geography*, at about 5s. 6d. each. Information on this service should be requested from the Assistant Secretary at headquarters.

A LIBRARY OF AERIAL PHOTOGRAPHS

We are asked to record the following information regarding the Aerofilms Library which has recently been transferred to new premises at 4 Albemarle Street, London, W.1. It houses a remarkable collection of aerial and ground photographs which has been built up since 1919 when Aerofilms Limited became the first British firm to specialize in commercial aerial photography. Many photographs taken by their Associate companies in the Commonwealth and other parts of the world are available, and photographic companies in Europe, the U.S.A. and elsewhere also contribute to the vast collection of over 100,000 aerial photographs.

The Library aims to illustrate, amongst other things, the earth's surface in all its forms, forestry, agriculture, irrigation, geology, communications, villages, townships, developed and undeveloped areas in the United Kingdom and other parts of the world. Many of the photographs are proving to be of value to educational authorities and can be used with good effect as an aid to teaching.

Aerofilms have published an illustrated classified Index listing the range of the subject matter held in the Library. The Index has thirteen sections summarizing the range of photographs in each main category of the classification system—Agriculture, Architecture, Archaeology, etc. Each subject is broken into subheadings so that any type of photograph can be selected. Lecturers, teachers and schools can obtain this illustrated Index Book (price 7s. 6d. including postage) from Aerofilms Limited at the above address. A visit by teachers of geography to this interesting library is well worth while, but if such is not possible arrangements can be made for selections of photographs to be posted for consideration; reference should first be made, however, to the Index.

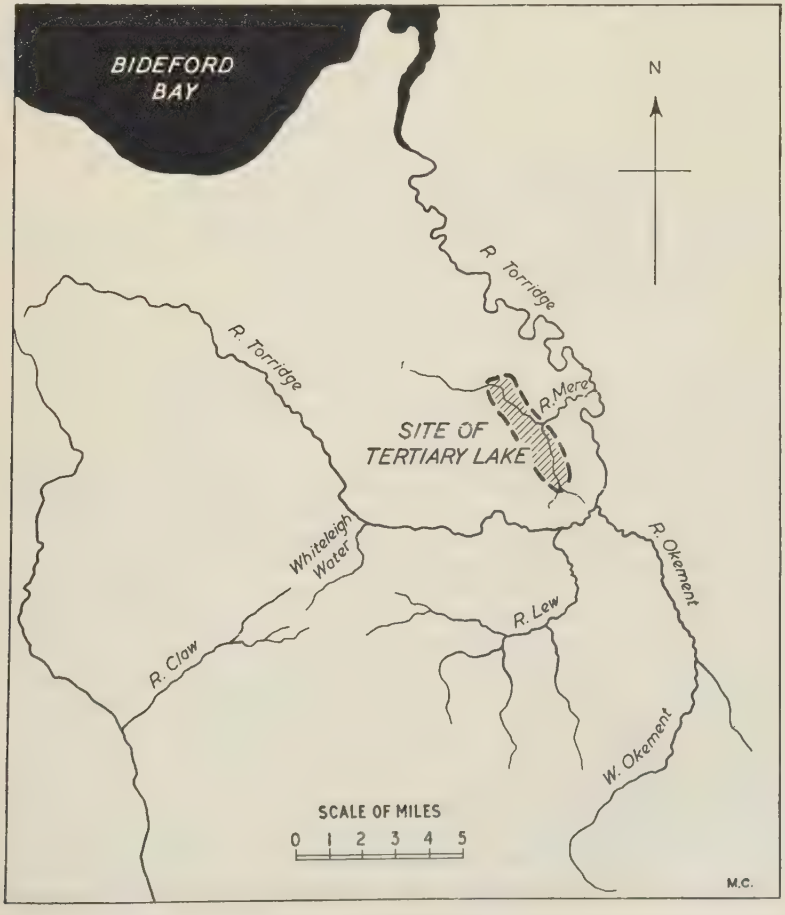
Correspondence

THE RIVERS OF CENTRAL DEVONSHIRE

I have read, with great interest, Professor Wooldridge's account of The Physique of the South-West in the November 1954 issue of *Geography*. During six years as Senior Geography Master at Bideford Grammar School I gave considerable thought to this subject and should like, with your permission, to draw the attention of Professor Wooldridge and your readers to certain aspects of this problem.

Sir Halford Mackinder suggested in *Britain and the British Seas* that the Torridge had captured a source stream of the Tamar. Professor Wooldridge implicitly rejects this and thinks it probable that the upper Torridge once flowed eastwards to the Exe drainage. It seems to me there is an insuperable difficulty to the latter theory. The Petrockstow and Marland pipe clays are lacustrine deposits and are believed, like the comparable Bovey Tracy deposits, to derive from the granitic mass of Dartmoor and to be, as Professor Wooldridge mentions, of Oligocene or Miocene age. But a stream from Dartmoor would have had to cross the eastward-flowing stream postulated by Professor Wooldridge.

If Mackinder's theory is correct the elbow of capture suggested by the map is at the point where a small tributary (in a surprisingly wide valley) known as Whiteleigh



water enters the Torridge. This stream rises within half a mile of the river Claw, a tributary of the Tamar. Clayden's suggestion of a former eastward continuation of a reversed lower Torridge seems almost equally suspect. The case for reversal is clear enough, and would account for the incised meanders of the lower Torridge, for the stream which brought the Marland clays, for the increased erosive power which subsequently drained off the Tertiary Lake (via the river Mere) and for the capture first of the Dartmoor stream (perhaps the Lew) and then of the upper Torridge. But should we not expect that at least part of Clayden's eastward-flowing stream would also have been deeply incised in the plateau?

Is there any reason why the Torridge should not, prior to the disturbance which produced reversal, have continued to flow S.E. across Dartmoor? The lower Okement is exactly on this line and so is the great depression across Dartmoor now occupied by the Wray brook, and also the Bovey.

I would suggest that a study of the long profiles of all the rivers of the southwest might throw considerable light on the history of this interesting but difficult region. During my stay at Bideford I constructed a number of such profiles and find those for the Tamar and the Torridge of particular interest. In sum (I shall be glad to give details to anyone interested) the Tamar and those of its tributaries which do not rise in either Dartmoor or Bodmin Moor exhibit uninterrupted profiles except where river capture has occurred. Those rising in either of the granite masses have interrupted profiles, though at least in the case of the Lyd and probably also of the Inny the lower courses may be considered as the original streams and are true to type, while the upper, more complicated, courses have been added by capture. The Torridge exhibits two interruptions in profile, but the profiles of its tributaries are not accordant with that of the main stream. The Okement–Torridge regarded as one stream has three breaks in profile below 750 feet. This agrees with those tributaries which come in nearer the mouth than the lowest break in the main stream profile. The upper and middle Torridge regarded as a tributary of the Okement–Torridge has one break only—at the suggested elbow of capture.

I refrain from any attempt at interpretation beyond remarking that the simplicity of the Tamar curves contrasts strongly with the complicated nature of those of the Torridge system and suggests the long continued stability of the Tamar basin, of which the upper Torridge may have been a part.

Mill Lane, Timsbury, Bath. C. Penrose.

I am interested in the points raised by Mr. Penrose but I am far from agreeing with the conclusions he draws or implies.

In the first place I do not regard the provenance from Dartmoor of the Petrockstow clays as yet sufficiently proved, though it is evidently quite possible that such is their source. I regard the Petrockstow depression as occupying the floor of a rift valley which crosses the peninsula from side to side, including also the Bovey basin. I do not doubt that following its formation there was drainage towards this trough from both sides and that, in particular affluents reached it from the southwest—i.e. from Dartmoor. But these minor streams would be wholly subordinate to the main drainage—i.e. the outflow from the lake and for this there are, so far as I can see, only two possible routes, either south-eastwards along the line of the rift or eastwards towards the Exe as I have indicated. The latter still impresses me as the much more likely route since structurally it is synclinal. It would be naïve to assume that the rift faulting occurred in isolation. It was almost certainly part of or incidental to more general movements of folding or warping. This leads me to note that it is vital to decide what *date* we are considering. If it is that immediately succeeding the last main Tertiary earth movements in Devonshire then I insist that Clayden's reconstruction remains probable. If, on the other hand, the drainage which I have reconstructed in Fig. 1 of my paper dates from some later date following marine

planation, an easterly course to the Exe is less easy to deduce or justify. These questions of date are crucial. Thus, while I agree with Mr. Penrose that the long profiles of all the rivers will afford vital evidence, it appears to me that the instances of incision or rejuvenation to which he refers are of much later date than the main "switches" of the original or earlier drainage system. Unless I am much mistaken in fact they are like "the flowers that bloom in the spring."

In brief I would say that it is not river-lines but "time-lines" which are in danger of crossing each other in this argument. So far as concerns Mr. Penrose's main point, it is the very presence of the Petrockstow lake which makes it unnecessary for any north-eastward drainage from Dartmoor to cross anything. The question at issue is, as I have indicated, the direction of outflow of the lake.

I think it is possible that the upper Torridge was at one stage an affluent of the Tamar and I readily acknowledge that the alignment of the lower Torridge and the Okement may well be significant, though once again I immediately enquire, at what date can we reasonably assume a continuous south-easterly course along this line. I have written elsewhere (in *The Physical Basis of Geography*, p. 255) that a full study of British drainage history "must embrace much more than the study of patterns on the map. Such patterns may suggest much but they can prove nothing. Their indications must be combined with all the evidence bearing on the later geological history of the area." This I am sure Mr. Penrose realizes. Indeed his letter implies it and I am delighted to have found someone interested in this rather neglected corner of our country which offers rich and ample scope for further research.

University of London. S. W. Wooldridge.

Reviews of Books

With very rare exceptions, books reviewed in this journal may be borrowed from the Library by full members or student library members of the Association.

Northamptonshire (County Books Series). T. Ireson. 14 × 22 cm. 334 pp. London: Robert Hale Ltd. 1954. 18s.

To most travellers Northamptonshire is a *durchgangsland* rather than a destination. Its landscape is nowhere spectacular, save in the area of ironstone working around Kettering, and the most pleasing parts lie away from the main roads and rail routes. Primarily for these reasons Northamptonshire is rarely accorded a volume to itself (in literature as in life it is passed over), a fact which makes this addition to the County Series doubly welcome.

The author is a proud native of the county, a journalist and a townsman, three qualifications which colour his treatment of the subject. Social history provides much of his material, for the past is here more productive of a stirring story than the present-day scene. There is information upon a number of geographical topics, but oddly enough, next to nothing about the tanning of leather or the varieties of farming practised within the region. Village life indeed, is given inadequate attention for a county where one third of the inhabitants (more than the number in Northampton itself) are living in Rural Districts, so that water supply, for example, is touched upon without any mention of the large Pitsford reservoir, now in course of construction.

Excellent photographs enhance the value of the book, and the publishers anticipate the geographer's complaint that the solitary map is inadequate by referring the reader to the relevant sheets of the Ordnance Survey. Nevertheless the interesting chapter on Northampton would gain by the addition of a town plan.

There is here no profound study of the interplay between physical and human influences, and many of the personalities described have a fortuitous rather than a geographical connection with the county. Nevertheless the book is easy to read and it contains shrewd observations upon places which are rarely mentioned outside the pages of the local press. L. J. J.

The Scilly Isles (The Regional Books). C. C. Vyvyan. 14 × 22 cm. viii + 243 pp. London: Robert Hale Ltd., 1953. 18s.

This account clearly reveals the author's intimate knowledge of, and affection for, the Scilly Isles. It is regrettable that much that would be of interest and use to geographers has been omitted. The treatment belongs to the late nineteenth-century school of topography and includes much gossip and personalia. The peculiar atmosphere of the Islands is evoked with some success, but it could be wished that less attention had been paid to trivia and more to matters of geographical importance, including physique and land use. It is significant that, in a bibliography of forty-six items, thirty date from the nineteenth or earlier centuries, and that the L.U.S. Report is not mentioned. Neither is there comparison with, for example, the Channel Islands, which could have illustrated a number of arguments.

Illustration consists of well-chosen full-page plates. A general map appears as an end-paper. G. H. D.

Skye and the Inner Hebrides (County Book Series). A. A. MacGregor. 14.5 × 22 cm. xi + 327 pp. London: Robert Hale Ltd. 1953. 18s.

Of sixty photographs, almost every one has a value of its own in composition, landscape or romance, with here and there a pleasant portrait. The acknowledgments of the author are made to the photographer, himself, with justifiable pride. There is an index map. Each of the twenty-two islands described has its own chapter, the less-known being described at relatively greater length. The book begins poorly with a chapter on Skye, composed of scraps of anecdote, archaeological information, reminiscence and comment, with generalizations which lack a firm basis of fact and are too often in doubtful taste. Chapters on smaller and simpler subjects are rather happier, whether written in note form or upon a theme, as is the chapter on Iona. It is to be regretted that a talented writer with a life-long acquaintance with the Isles should compose a topographical book mainly of three disparate elements: blood feuds, Celtic "piety" and local gossip, with so little foundation in geographic environment or grasp of the enduring strands of Gaelic life.

A. G.

Mountains and Moorlands (New Naturalist Series). W. H. Pearsall. 15 × 22 cm. xv + 312 pp. London: Collins. 1953. 21s.

This is a book which has been already recognized as a classic. Professor Pearsall has described the scenery of upland Britain in its entirety, using language that can be understood by a reader with no detailed knowledge of natural history. He has achieved this without any over-simplification of complex ecological problems.

The book is dedicated "to all naturalists"; it may equally well be commended to all geographers, so well does it integrate the different facets of the natural landscape. Not only are geology, morphology, climate and biogeography all welded together in a glorious ecological whole, but this intricate complex is put into its proper historical perspective. The reader thus sees the present landscape as an episode in its evolutionary setting.

The glossary of technical terms is a further help to those with little scientific training and the numerous illustrations show familiar scenes in a context which cannot fail to provoke new attitudes towards the landscape of northern Britain.

S. R. E.

British Caving: an introduction to speleology. C. H. D. Cullingford (ed.). 15.75 × 25.5 cm. xvi + 468 pp. London: Routledge and Kegan Paul Ltd., 1953. 35s.

This book may well attract a large number of new recruits to the caving clubs of England and Wales. It sets out the scientific achievements of the present generation of cavers in all natural openings from rock shelters to cavern systems, and includes an exhaustive treatment of caving technique. G. T. Warwick contributes the first five chapters which comprise a geographical introduction to cave formation and occurrence. The chapter on cave-dwelling bats must be singled out as a fascinating account with excellent illustrations. The long contribution on archaeology is disappointing; a regional sequence of description is adopted and there is no general summary of the evidence. It is interesting to note that the contributors to this book took up caving as a sport and then turned to the scientific aspects of caves; perhaps the next generation will include some scientists turned cavers, for here is a still largely untouched field of research. K. M. C.

Agricultural Development and Rural Reform in Denmark. F. Skrubbeltrang. 15 × 23 cm. 320 pp. Rome: U.N.F.A.O., 1953. 15s.

This publication describes the marked evolution of Danish agriculture since about 1784, when the nucleated village with its strong three-field system still existed over most of Denmark, excluding the heath plains of western Jutland, and examines the social, economic and political background to the striking changes which have since occurred. After summarizing the elementary geographical facts about Denmark, the author outlines the main phases in its agricultural history, illustrating them throughout by reference to the village of Vejen in southern Jutland whose parish spans hummocky moraine and outwash plain. Like so many Danish villages Vejen, still feudal before 1784, has developed through a period of enclosure and subsequent "flitting" of farms into an important station town today. Such a treatment lends itself to the use of maps but none is included. The book, which is well written and factually sound, provides valuable background reading for the geographer with an interest in rural Denmark. H. T.

Growing Up in New Guinea. M. Mead. 11 × 18 cm. 270 pp. Harmondsworth: Penguin Books Ltd. 2s. 6d.

The value of this authoritative work has not diminished, although nearly twenty-five years have elapsed since it was first published; the present volume is a reprint of the Pelican edition of 1942. Geographers seeking to understand some of the problems of the backward peoples of the world will find invaluable this study of the customs and ideals of the inhabitants of Manus in the Admiralty Islands. Written by an anthropologist interested primarily in the ethnological approach to social psychology, it naturally leaves unanswered many questions a geographer would pose; but it includes an extremely useful appendix on "man and his work" in the Manus group. It is now a classic and should be on the bookshelves of everyone interested in the study of man and his environment. E. M. J. C.

Plant Life in Malaya. R. E. Holttum. 14.25 × 22 cm. viii + 254 pp. London: Longmans Green & Co. 1954. 18s.

Any contribution to tropical plant geography is welcome. This book, unfortunately, will not afford much assistance to the regional or plant geographer. It is intended mainly for students and teachers of botany, especially Malayan residents. The approach is strictly biological and non-regional. It concentrates upon the growth-habit and structure of selected groups of plants common, but not necessarily restricted, to Malaya. The only chapters of real interest to the geographer are the first, discussing some aspects of the climatic responses of certain plants, and the last, dealing with the general character of the Malayan forest. The book lacks both maps and bibliography. J. O.

L'Asie. Pierre Gourou. 14 × 22 cm. 541 pp. Paris: Hachette, 1953. 1,750 fr.

This study, by the doyen of geographical experts on the tropics, is the best and most up-to-date study of Asia, exclusive of the U.S.S.R.

Part One describes the physical background and shows its effect upon man. Population is then examined in its ethnic and spatial aspects, and agriculture, fishing and hunting are related to, among other things, food habits.

Discussion of individual countries occupies the other four-fifths of the book. It comprises not only analyses of the physical, human, regional and economic geography of each land but related material in the fields of archaeology, history, sociology and social anthropology. There is also a chapter on petroleum in Western Asia. Each part of non-Soviet Asia is given due attention, for Professor Gourou has resisted the urge to give more than a fair share to Southeast Asia, of which he has made so much study.

There is a very full bibliography and the book is profusely illustrated with superb photographs, clear diagrams, delightful drawings and many maps, several being in colour. Hachette's too are to be congratulated upon producing a beautiful book, with clear type and good paper to carry this excellent text. This book should be used by all doing senior work on Asia and could be introduced to pupils as a fine example of French geographical writing. R. J. H. C.

Where Winter Never Comes. M. Bates. 13 × 20.25 cm. 310 pp. London: Victor Gollancz Ltd. 1953. 16s.

The author of this book is an American biologist with great tropical experience, who has set out to write a "natural history of tropical man." His book has its faults, notably a rabid and misinformed anti-colonialism, a failure to make a clear statement about tropical soils and the adaptation to them of such techniques as shifting agriculture and rice cultivation, and a style that many will find too breezy and discursive. But it does stress things which need to be stressed, especially the pleasant side of the tropical environment, the important rôle of the tropics in human biological and cultural evolution, and the view that the failure of Western societies to adapt themselves to tropical conditions is the fault of Western civilization rather than of the tropics. The book will serve as a very useful counter to the ignorant ethnocentricity which permeates so much writing about the tropics, not least geographical writing; and it will also act as a suitable complement to Pierre Gourou's *The Tropical World.*

B. H. F.

Australian Commonwealth Scientific and Industrial Research Organization. Land Research Series. 1. Survey of Katherine-Darwin Region, 1946 (extract). 24 pp. 1952. **2. Survey of Townsville–Bowen Region, 1950** 87 pp. 1953. **3. Survey of the Barkly Region, 1947–48** (extract). 55 pp. 1952. 17.5 × 24 cm. Melbourne: Commonwealth Scientific and Industrial Research Organization. n.p.

These are first-rate examples of the results of scientific teamwork, whose principal object was "to record accurately the nature of the country and to establish a sound basis upon which the production possibilities of the regions might be appraised."

Apart from the important conclusions, by far their most revealing and satisfying aspect is the actual survey method. In order to give a scientific foundation to the undertaking, it was necessary to classify, in a systematic way, the permanent qualities of the country, that is "the inherent land characteristics, to recognize areas with common or dissimilar origins." Thus the description was based not on the simple single units of detailed land classification, nor on any incoherent association of the lesser divisions, but on their combination into Land Systems, which are assemblages

of distinct "sites" in their morphological, pedological and ecological relationships. In English terminology they are "tracts." These Systems and their constituent patterns of recurring topographical, pedological and vegetational units have been "condensed and simplified" into annotated regional transects. Without them, the previous formal chapters on land surface, soils and plants are so much unsynthesized literary dross, however factually important.

The assessment of each System for land-use potential is made either individually (as in No. 1) or, in the instance of greater economic development (No. 2), more collectively, in the form of Land Use Groups studied in relation to climate, present land use and the possibilities for irrigation. These further aggregations cannot fully qualify for the title of morphological "sections," but their easy demarcation after correlating the Land Systems with the facts of social geography is sufficient proof of the logic and integrity of the method in reducing vast and complicated areas to order. Full and successful use was made of aerial photographs, especially in the Townsville–Bomen region where the Land Systems were tentatively outlined from a preliminary examination of the photographic patterns and the itinerary of land traverses planned to meet as many types of country as possible.

The conclusions hold no great promise for the future of these areas. At present the Katherine–Darwin region possesses neither attractions for capital, nor any bulk of economically marketable goods (apart from radio-active minerals), nor the population adequate to raise its level of production alone. The innumerable problems of development and production remain to be solved on the ground in a research programme of long term "pilot" schemes. But however limited the recommendations for development these reports have made it possible to relate them to the intimate details of the land surface and indicate logical aims with the greatest likelihood of success. They advise concentration on agricultural development with interdependent industries converting the produce into economically exportable goods. There can be nothing of a spectacular T.V.A. character in the future of northern Australia. One dares to compare promises from other parts of the world with these sober assessments of land potential. R. W. C.

An Introduction to Climate. G. T. Trewartha. 3rd edition revised. 13.75 × 26.25 cm. vi + 402 pp. London: McGraw-Hill Publishing Co. Ltd., 1954. 50s.

This may be fairly described as a new "mammoth" edition of a text which has been a favourite with teachers of climatology since 1937. It is rewritten, reset and equipped with a vastly increased armoury of diagrammatic illustrations. Professor Trewartha has been indefatigable in his effort to keep pace with a rapidly expanding field of knowledge and the volume forms a full introduction to a great mass of more specialized literature.

The chief additions are:—(a) a lengthened treatment of the mean surface winds of the world; (b) a discussion of the significance of jet streams in the general circulation; (c) an elaborated and richly illustrated section on air masses and weather types; (d) a thoughtful analysis of the problem of climatic classification. Some half-tone plates have been omitted and the separate charts formerly contained in a pocket have been either incorporated in the volume or discarded.

If criticism of this handsome volume is to be attempted it must refer, in the first place, to the difficulty of combining the encyclopaedic approach with digestibility. Is it not possible to have really too much of a good thing in what purports to be an introductory text? The wealth of illustration is now almost overwhelming to the beginner whilst the more discerning reader will find himself hard put to tracing many of these figures to their sources to discover their method of construction and hence their degree of reliability. Even in the text, especially in regard to the mutual relationship of pressure and wind, the introduction of ideas from modern dynamical

meteorology has outdated introductory paragraphs so that within the same chapter a student may find himself unlearning what he has just striven to master.

Specific errors are few and by no means serious. Unchanged from earlier editions Fig. 2.15 remains not strictly correct and the suggested demonstration of Coriolis effect by globe and ruler (p. 65) fails miserably if some bright member of the class obstinately and quite logically insists on turning the globe full circle. In the new figures, something very strange has happened to the S.E. trades in Fig. 2.36 whilst Fig. 2.31 has significance only within a context which must be sought elsewhere. The areas mapped are those in which some trace of a westerly component, however slight, is recognizable in the mean intertropical circulation. Surely this is much too wide a definition of the "core area of the equatorial *westerlies*!"

The price of this book in England will tend to confine it to class libraries. There it will provide a veritable mine of information to be worked as required.

P. R. C.

Map Interpretation. G. H. Dury. 14.5 × 22.4 cm. xii + 203 pp. London: Pitman & Sons, Ltd., 1952. 15s.

Although not written into the title this book is in fact concerned with *topographical* maps. In the first part of the work, type studies are made of contrasted physical landscapes and in the second part features of occupance are discussed, fullest treatment being accorded to rural settlement, towns and the evidence of prehistory. Teachers and students alike will undoubtedly find the analyses of considerable help, but since the author very properly takes the view that the ultimate aim in map interpretation must be to appreciate the wholeness of an area, i.e. to take a synthetic and not an analytic view, some examples of maps treated thoroughly as complete studies in interpretation might have been included. Such examples could have provided opportunity for a salutary demonstration that, in map interpretation, questions are often posed that are not capable of solution from the map evidence alone. Such regional interpretation could have been more valuable than the two chapters on the special topics of morphological analysis and cartographical appreciation that make up the third section of the book. The production, illustrations and references are well done and the only typographical error noted is in the caption to Fig. 12 where "plantation" has escaped amendment to "planation." N. P.

Introduction to Human Geography. D. C. Money. 14 × 22 cm. viii + 332 pp. London: University Tutorial Press. 1954. 15s.

A warm welcome will be given to this comprehensive survey of human geography, issued at a very reasonable price and with less than half the bulk and weight of comparable American publications. It is designed for those reading for the advanced level of the General Certificate Examination and for entrance examinations to the forces, but it is equally suitable for the general reader as an introduction to the geographical background of world problems. The author has gone to great pains to assemble a complete series of photographic illustrations, and the abundant sketch maps and diagrams are commendably clear. Only occasionally, as in Figs. 57 and 58 (of head-forms in Europe) does his zeal for maps carry him too far and lead to contradictions. Inevitably, in a work which ranges so widely, there are over-simplifications here and there, but errors are few. The main themes are patterns of settlement, rural and urban, political units, world populations, colonial problems, and regional surveys, the last section illustrated by a portion of the one-inch O.S. map of Dorset. The sources of further reading which are given might be criticized as containing a high proportion of articles from a semi-popular magazine, but the items are carefully selected. The author has read widely and made good use of his reading.

E. E. E.

Geographical Articles

Listed from Periodicals received in the Library

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(Held over from vol. xl, January 1955)

Journals listed here may be borrowed from the Library by members of the Association. References are listed according to the classification published in the *Annals of the Association of American Geographers*, vol. xxvii, June 1937. Authors' reprints presented to the Library are included in the list of articles. New additions to periodical accessions (since the last publication of this list) are shown below in italics.

AJ—Alpine Journal. A of G—Annals of the Association of American Geographers. A of Sc—The Advancement of Science. BE—Bulletin de la Société de Géographie d'Egypte. EG—Economic Geography. EMG—*East Midland Geographer*. GJ—Geographical Journal. GR—Geographical Review. GRI—Geographical Review of India. IGJ—Indian Geographical Journal (formerly Journal of the Madras Geog. Assoc.). MJTG—*Malayan Journal of Tropical Geography*. NG—New Zealand Geographer. NSWR—Bank of New South Wales Review. PGA—Proceedings of the Geologists' Association. PGR—Pakistan Geographical Review. PRST—Papers and Proceedings of the Royal Society of Tasmania. RCG—Revue Canadienne de Géographie. RGA—Revue de Géographie Alpine. RGL—Revue de Géographie de Lyon (formerly Les Etudes Rhodaniennes). RSE—Revue des Sciences Economiques. SR—Sociological Review. T—Terra. UE—United Empire.
(E)—English Summary. (F)—French Summary. (G)—German Summary. *—Map.

PHYSICAL GEOGRAPHY, R. L. CLOET, GJ, June '54.—Hydrographic analysis of the Goodwin sands and the Brake Bank. J. CORBEL, RGL, No. 1, '55.—Karsts tropicaux. C. A. COTTON, GJ, Sept. '54.—Tests of a German non-cyclic theory and classification of coasts. R. LEBEAU, RGL, Nos. 3 and 4, '54.—Formes mineures du relief sous-glaciaire. J. A. STEERS, A of Sc, Sept. '54.—Coast and the geographer.

ECONOMIC GEOGRAPHY, B. D. COPLAND, GJ, Dec. '54.—Practical application of the theory of Hinterlands. D. HEATHCOAT-AMORY, UE, July–Aug. '54.—Future pattern of Commonwealth trade. G. M. LEES, UE, Sept.–Oct. '54.—World oil reserves. V. ROTERUS and W. CALEF, EG, Jan. '55.—Notes on the basic-nonbasic employment ratio. A. F. SPILHAUS, GR, July '54.—Sea and air resources. J. SYKES, SR, Dec. '54.—Social aspects of the control of industrial location. O. TUOMINEN, T, No. 3, '54.—Funktionale Gebiete (G). G. VEYRET-VERNER, RGA, Pt. 1, '55.—Transport de force et répercussions en géographie industrielle. S. S. VISHER, EG, Jan. '55.—Comparative agricultural potentials of the world's regions.

BRITISH ISLES, C. E. BROWN, SR, Sect. 2, '47.—Historical geography of Herefordshire. K. C. EDWARDS, EMG, June '54.—East Midlands; general considerations. G. J. FULLER, EMG, Dec. '54.—Geographical aspects of the development of Boston (Lincs.) between 1700 and 1900 A.D. J. W. HOUSE, RSE, Dec. '54.—Grande-Bretagne et la Communauté Européenne du Charbon et de l'Acier. J. KEMPE, SR, Sect. 1, '49.—Pilot survey of Much Marcle, Herefordshire. P. LEAY, EMG, June '54.—Market garden industry of Melbourne district, South Derbyshire. D. B. McINTYRE, PGA, Sept. '54.—Moine Thrust—its discovery, age and tectonic significance. A. A. MILLER, A of Sc, Dec. '54.—Mapping of strip lynchets. R. MILLER, R. COMMON and R. W. GALLOWAY, GJ, June '54.—Stone stripes and other surface features of Tinto Hill. R. H. OSBORNE, EMG, Dec. '54.—Population concentrations and conurban tendencies in the middle Trent counties. A. G. POWELL, EMG, Dec. '54.—1951 Census: analysis of population changes in Derbyshire. E. M. RAWSTRON, EMG, Dec. '54.—Blast furnace centres in Britain. E. M. RAWSTRON, EMG, Dec. '54.—Power production and the river Trent. E. M. RAWSTRON, EMG, June '54.—Three maps on coal production. Lord RENNELL of RODD, GJ, Dec. '54.—Aids to the domesday geography of northwest Hereford. J. SMITH, EMG, June '54.—Geographical conditions affecting grain milling in the Nene basin. T. M. THOMAS, GJ, No. 4, '54.—Swallow holes in the South Wales coalfield. A. E. TORAYAH, BE, Sept. '54.—Climate of the British Isles. Classification based on accumulated temperature, duration of growing season and precipitation effectiveness. G. H. WEDLOCK, EMG, June '54.—Loughborough: outline urban survey. G. A. WORRALL, PGA, June '54.—Lower Greensand in East Kent. E. M. YATES, SR, Dec. '54.—Settlement of northwest Sussex.

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ASIA, C. BALASUBRAMANIAN, IGJ, Jan.–Mar. '54.—Rainfall in the Central Zone of the Madras State. V. BARTLETT, UE, July–Aug. '54.—Position in Malaya. B. BINERJEE, GRI, June '54.—Relief as a factor in the location of the West Bengal tea gardens. W. C. BRICE, GJ, Sept. '54.—Population of Turkey in 1950. CHONG SECK-CHIM, MJTG, Oct. '54.—Development of Kuala Lumpur District. G. B. CRESSEY, EG, Jan. '55.—Changing the map of China. M. K. ELAHI, PGR, No. 1, '54.—Geographic controls in the Submontane Region of West Pakistan. N. C. FIELD, GR, No. 4, '54.—Amu Darya: a study in resource geography. C. A. FISHER, GJ, Sept. '54.—Role of Korea in the Far East. W. FRAUENBERGER and H. BUHL, AJ, Nov. '54.—Ascent of Nanga Parbat. H. HARRER, GJ, June '54.—My seven years in Tibet. R. HAY, GJ, Dec. '54.—Persian Gulf states and their boundary problems. F. O. JONES, GR, Oct. '54.—Tukiangyien: China's ancient irrigation system. P. P. KARAN, GRI, Mar. '54.—Structure and surface of India and Pakistan. M. N. KHAN, PGR, No. 1, '54.—Climate of Sind. S. KRISHNASWAMI, IGJ, Jan.–Mar. '54.—Coasts of India. J. H. G. LEBON, EG, Jan. '55.—New irrigation era in Iraq. LIM JOO-JOCK, MJTG, Oct. '54.—Tradition and peasant agriculture in Malaya. A. B. MUKERJI, GRI, June '54.—Jats: a study in human geography. X. de PLANHOL, RGA, Pt. 4, '54.—Vie de montagne dans le Sandras Dag (Turkey). W. L. POWERS, GR, July '54.—Soil and land-use capabilities in Iraq: a preliminary report. L. G. C. E. PUGH, GJ, June '54.—Scientific aspects of the expedition to Mount Everest, 1953. F. W. ROE, MJTG, Oct. '54.—Plateaux and falls of East Sarawak. A. SATTAR, PGR, No. 1, '54.—Land utilization survey of Mohar village. K. P. SEN, GRI, Mar. '54.—Aspects of the recent colonization in the Andamans. S. SEN, GRI, Mar. '54.—Physiography of the central Mayurakshi Basin. A. H. SIDDIQI, IGJ, Jan.–Mar. '54.—Industrial geography of the Karachi area. B. SINHA, GRI, Mar. '54.—Agronomy in Jira and Jhuan basins. H. R. A. STREATHER, AJ, Nov. '54.—K2: 3rd American Karakorum expedition. G. J. A. TERRA, MJTG, Oct. '54.—Mixed garden horticulture in Java. W. THESIGER, GJ, Sept. '54.—Marshmen of Southern Iraq. J. B. TYSON, AJ, Nov. '54.—Exploring the Api and Nampa Group, W. Nepal. A. ULLAH, PGR, No. 1, '54.—Physiography and structure of S.W. Makran. E. de VAUMAS, RGA, Pt. 4, '54.—Terrasses d'abrasion marine de la côte syrienne. I. E. M. WATTS, MJTG, Oct. '54.—Line-squalls of Malaya.

AFRICA, M. M. ALSAYYAD, BE, Mar. '53.—Water supply and the Sudan economy. M. AWAD, BE, Mar. '53.—Diffusion of Arab influences in the Sudan. M. BARBOUR, GJ, June '54.—Wadi Azum. H. BLOOD, UE, Sept.–Oct. '54.—Mauritius today. H. C. BROOKFIELD, EG, Jan. '55.—New railroad and port developments in East and Central Africa. D. BUSK, GJ, June '54.—Southern glaciers of the Stanley group of the Ruwenzori. D. L. BUSK, AJ, Nov. '54.—Notes on Ruwenzori. A. DESIO, BE, Mar. '53.—Evolution morphologique de Libye. J. DESPOIS, BE, Mar. '53.—Types d'irrigation et modes de partage et de possession des eaux dans les plaines du Hodna, Algérie. M. G. ELFANDY, BE, Mar. '53.—Rains that lead to the Nile flood. M. I. HASSAN, BE, Sept. '54.—Physical elements of agricultural land use in the Fayum depression. J. M. HOUSTON, GJ, Sept. '54.—Significance of irrigation in Morocco's economic development. F. JOLY, BE, Mar. '53.—Essai d'une définition du Presahara marocain. K. KAMEL, BE, Mar. '53.—

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AUSTRALASIA, BANK OF NEW SOUTH WALES REVIEW, No. 15, '53.—Australian transport problems. BANK OF NEW SOUTH WALES REVIEW, Nov. '53.—Sugar in Fiji. J. BRADLEY, PRST, Vol. 88, '54.—Geology of the West Coast Range of Tasmania. R. N. BROTHERS, NG, No. 1, '54.—Physiographical study of recent sand dunes on the Auckland west coast. J. E. COALDRAKE, GR, July '54.—Sand dunes of the ninety-mile Plain, Southeastern Australia. C. M. DAVIS, GR, Oct. '54.—Merino sheep on the Australian Riverina. B. H. FARRELL, NG, No. 1, '54.—Thames district. A. HUETZ DE LEMPS, RGA, Pt. 1, '55.—Relief de la Nouvelle-Zélande. H. LUKE, GJ, Dec. '54.—Easter Island. A. MULGAN, NG, No. 1, '54.—New Zealand railways: romance and story. A. VICKERS, UE, Nov.–Dec. '54.—Flying doctor service. W. H. WALLACE, NG, No. 1, '54.—Transport in New Zealand; a review.

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